DIGITAL TECHNOLOGIES IN THE PROCESS OF TEACHING STEM DISCIPLINES: CHALLENGES AND PROSPECTS

AS TECNOLOGIAS DIGITAIS NO PROCESSO DE ENSINO DAS DISCIPLINAS STEM: DESAFIOS E PERSPECTIVAS

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Abstract. The modern integration of digital technologies into the educational process requires additional study, given the opportunities that this process opens up. The purpose of the article is to study the use of digital technologies in STEM education through the prism of researching the main challenges and prospects. To achieve this goal, the methods of questionnaires and interviews were used. In particular, 65 teachers of higher education institutions were interviewed, whose opinions became the basis for forming a generalised picture of the study. The results show that modern teachers actively use digital technologies in STEM education. The average level of digital technology use among STEM teachers is high: 43 people (65%) use technology at grade levels 4 and 5. However, this intensive use of digital technologies in STEM education raises both challenges and opportunities. In particular, today's teachers often face limited access to the necessary technical infrastructure, which can limit their ability to implement digital tools. Poor quality of internet connection can affect the smoothness and efficiency of using online resources. Insufficient training of teachers in the use of digital technologies is also a significant challenge. Increasing the availability of digital resources for teachers will make learning more accessible and diverse. Cooperation between universities and technology companies also opens up new opportunities for the development of STEM education. The conclusions emphasise that such interaction facilitates the exchange of experience, access to advanced technologies and resources, and creates conditions for the implementation of joint projects and programmes.

Keywords: STEM education; digitalisation; technologies; transformations; challenges; prospects.

Resumo. A integração moderna das tecnologias digitais no processo educativo requer um estudo adicional, dadas as oportunidades que este processo abre. O objetivo do artigo é estudar a utilização das tecnologias digitais na educação STEM através do prisma da investigação dos principais desafios e perspectivas. Para atingir este objetivo, foram utilizados os métodos de questionários e entrevistas. Em particular, foram entrevistados 65 professores de instituições de ensino superior, cujas opiniões se tornaram a base para formar uma imagem generalizada do estudo. Os resultados mostram que os professores modernos utilizam ativamente as tecnologias digitais no ensino STEM. O nível médio de utilização de tecnologias digitais entre os professores de STEM é elevado: 43 pessoas (65%) utilizam tecnologias nos níveis 4 e 5. No entanto, esta utilização intensiva das

tecnologias digitais no ensino STEM suscita desafios e oportunidades. Em particular, os professores de hoje enfrentam frequentemente um acesso limitado à infraestrutura técnica necessária, o que pode limitar a sua capacidade de implementar ferramentas digitais. A má qualidade da ligação à Internet pode afetar a fluidez e a eficiência da utilização dos recursos em linha. A insuficiente formação dos professores na utilização das tecnologias digitais é também um desafio significativo. O aumento da disponibilidade de recursos digitais para os professores tornará a aprendizagem mais acessível e diversificada. A cooperação entre universidades e empresas tecnológicas também abre novas oportunidades para o desenvolvimento da educação STEM. As conclusões sublinham que esta interação facilita o intercâmbio de experiências, o acesso a tecnologias e recursos avançados e cria condições para a execução de projectos e programas conjuntos.

Palavras-chave: educação STEM; digitalização; tecnologias; transformações; desafios; perspectivas.

1. INTRODUCTION

In today's world, saturated with the rapid pace of technological development, teaching STEM disciplines (science, technology, engineering, and mathematics) is becoming not only an important component of the educational process, but also a challenge for the teaching community. With the advent of digital technologies in educational efforts, a new stage has been entered where teachers and students must adapt to a rapidly changing information environment.

Digital technologies in the teaching of STEM disciplines open up many new opportunities, but at the same time pose significant challenges. Teachers are faced with the task of integrating digital tools into teaching practices, ensuring that modern technologies are accessible to all students, and considering the individual characteristics of each student.

In this context, it is important to consider not only the technical aspects of using digital tools in STEM education but also their impact on the development of critical thinking, creativity, and a problem-based approach to learning. It is also relevant to explore how digital technologies shape the future generation of professionals and how they prepare students for the challenges of the modern labour market. For this reason, considering the challenges and prospects of using digital technologies in the process of teaching STEM disciplines is becoming an extremely important task that guides us on the path of constructive discussion and finding optimal solutions for the further development of education in the digital era.

In light of this, STEM education is seen in the scientific community as a deliberate approach to producing a new generation of experts who are better equipped to handle the demands of the contemporary technological environment. STEM education aims to mirror the real world, where activities and challenges typically call for the application of knowledge from a variety of scientific and technological domains (Pranata, Syahril, & Megahati, 2023). When it comes to STEM education, educators make sure that the curricula are practical, help students develop their technical abilities, and pique their interest in science and technology. This strategy aims to equip youth for the opportunities and difficulties of a technologically advanced modern world. However, in modern literature, the main attention is paid to the analysis of digital technologies, however, their potential in STEM education is not taken into account. Hence, this study will attempt to fill this gap.

Given the importance of understanding the views and experiences of teachers on the use of digital technologies in teaching STEM disciplines, a survey was conducted among 65 teachers. This allows us to get insights from professionals who interact directly with students and are at the centre of the educational process. Studying their views on the challenges and benefits of digital technologies in teaching STEM subjects can provide additional important aspects for improving teaching methods and strategies. Based on the data obtained, it is possible to identify the key aspects that teachers consider most important and relevant in the context of using digital technologies in STEM education. This study will serve as an important contribution to our understanding of how to optimise the learning process with the use of modern technologies, ensuring high-quality and effective STEM education for students.

Thus, the purpose of the article is to analyse the use of digital technologies in STEM education through the prism of researching the main challenges and prospects. The main research questions:

1. Describe the main technologies used in STEM education.
2. Identify the main challenges.
3. Identify promising areas of digitalisation of STEM education based on the challenges indexation.

2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

STEM education is an approach to learning that focuses on the integration of four core areas of knowledge: Science, Technology, Engineering, and Mathematics. This approach aims to develop students' skills in critical thinking, problem-solving, creativity, and communication to prepare them for the challenges of the modern world and labour market (Huffman, Thomas, & Basham, 2020). In the scientific discourse, STEM education is defined as an innovative teaching method that aims to develop an integrated understanding of scientific and technical principles (Bybee, 2013). It is seen as a means of developing key skills such as critical thinking, problem-solving, communication, and collaboration.

Therefore, in contemporary research, the term STEM education is used to describe the importance and necessity of an integrated approach to learning in science, technology, engineering, and mathematics (Chesky & Wolfmeyer, 2015; Huffman, Thomas, & Basham, 2020). Pedagogical research and publications in this area emphasise the importance of developing STEM competencies among students for their success in modern society (Hsu & Fang, 2019; Jamali, Ale Ebrahim, & Jamali, 2022; Pratama, Saputra, & Hikmawaty, 2024). Therefore, the scientific discourse highlights some key aspects of STEM education (see Table 1).

Table 1. Key aspects of the scientific study of STEM education

Aspect	Explanation	Scientific works
Theoretical background	Theoretical explanation of the STEM education phenomenon	Bakhmat, Kruty, Tolchieva, & Pushkarova (2022); Bybee (2013); Chesky & Wolfmeyer (2015); Hasan et al. (2024); Kennedy & Odell (2023); Krymets (2022); Peni, Dewi (2023); Tsekhmister, Chalyi, & Chalyy (2009).
Integration of disciplines	Research points to the importance of merging scientific, technical, engineering, and mathematical disciplines to promote deeper understanding and application of knowledge.	Bybee (2013); Hasan et al. (2024); Huffman, Thomas, & Basham (2020); Tkachenko et al. (2023); Sidorova, Smolina, Khomiakova, Andriichuk, & Romaniuk (2022).
Skills development	Aspects of education and the development of key skills, such as critical thinking, creativity, communication, and collaboration, are emphasised in research.	Hasan et al. (2024); Stohlmann, Moore, & Roehrig, (2012); Yuskovych-Zhukovska et al. (2022); Enguta Mwenzi & Andia Moyamani, (2023); Kharitonenko (2022).
Pedagogical approaches	Research in the scientific community examines effective teaching methods and	Hsu & Fang (2019); Jamali, Ale Ebrahim, & Jamali (2022);

	strategies in STEM education, as well as the challenges that may arise when implementing them.	Pérez Torres, Couso Lagarón, & Marquez Bargalló (2023); Salnyk, Grin, Yefimov, & Beztsinna (2023); Tsekhmister, Kotyk, Matviienko, Rudenko, & Ilchuk (2021).
Gender equality and accessibility	Aspects of identifying gender equality issues and ensuring accessibility of STEM education for different groups of students are also becoming the subject of scientific analysis.	Henry, Méango, & Mourifié (2024) Zander & Ertl (2023); Myronenko et al. (2022).
Implementation of ICT in STEM education	Identify the specifics of the use of information and communication technologies in this system.	Vandeyar (2013); Deyoe, Newman, & Lamendola (2015); Adegoke, Akinrinola, & Ogegbo (2023); Chabalengula & Banda (2023); Moosa, Ncube, & Ramnarain (2023); Tsekhmister, Konovalova, & Tsekhmister (2022).

Source: authors' development

Therefore, STEM education in the scientific discourse is perceived as a strategic direction for training a new generation of specialists with enhanced knowledge and skills that meet the requirements of the modern technological world. STEM education seeks to reflect the real world, where problems and tasks usually require the use of knowledge from various fields of science and technology (Pranata, Syahril, & Megahati, 2023). In STEM education, teachers make sure that curricula are focused on practicality, developing technical skills, and stimulating students' interest in science and technology. This approach seeks to prepare young people for the challenges and opportunities of a modern technological society.

3. METHODOLOGY

3.1. Research design

This study uses a mixed-methods research design that combines qualitative and quantitative approaches to provide a comprehensive understanding of the challenges and prospects of integrating digital technologies into STEM teaching. A stratified random sample will be used to ensure the representation of different STEM disciplines in the selected universities in Ukraine.

Duration of the study: The study will be conducted over a six-month period to ensure a thorough investigation and analysis.

3.2. Participants and data collection

Inclusion criteria

A. Participants are university professors who are actively involved in teaching STEM disciplines such as mathematics, physics, chemistry, biology, engineering, and computer science.
B. Teachers with different levels of experience are included to cover a variety of perspectives.
C. Experience of using digital technologies in teaching

3.3. Sample procedure

The study uses a stratified random sample. Universities are stratified based on their geographical location, size, and STEM discipline offerings. In each stratum, a random sample of teachers will be selected to ensure representation across universities and disciplines.

The procedure for recruiting participants involved contacting university administrations. Invitations were sent to potential participants through official university channels, including emails, departmental announcements, and notice boards. Emphasis was placed on the voluntary nature of participation, ensuring that teachers understood their right to refuse to participate without any repercussions. Clear communication was maintained regarding the non-disclosure of personal information and the use of data for research purposes only. However, participants were asked to provide basic demographic information such as age, gender, level of education, and teaching experience to facilitate comprehensive analysis. A survey was conducted among 65 teachers

3.4. The informed consent process

Prior to participation, teachers were provided with a detailed informed consent form explaining the purpose, procedures, potential risks, and benefits of the study. They were encouraged to ask questions and seek clarification before voluntarily signing the consent form.

3.4.1. Anonymity and confidentiality

Personal identifiers will be removed from the data collected to ensure the anonymity of participants. Confidentiality measures will be applied to protect participants' sensitive information (see Table 2).

Table 2. Information about the research participants

STEM Discipline	
Physics	25%
Computer Science	20%
Chemistry	15%
Mathematics	10%
Biology	20%
Engineering	10%
Teaching Experience	
Less than 5 years	15%
5 to 10 years	40%
10 to 15 years	25%
More than 15 years	20%
Age	
25-30 years	10%
31-40 years	30%
41-50 years	40%
51-60 years	15%
Over 60 years	5%
Gender	
Male	60%
Female	40%

Source: compiled by the authors

3.4.2. Data collection tools: Survey questionnaire

A structured questionnaire was developed to collect quantitative data on teachers' experiences, concerns, and perceptions of using digital technologies in STEM teaching. An example of the questionnaire is presented in Table 3.

Table 3. Questionnaire survey

Use of digital technologies	To what extent do you use digital technologies in your teaching of STEM subjects? - 1 - Almost never use - 2 - I don't use much - 3 - I use it moderately - 4 - I use a lot - 5 - I use it to the fullest extent What specific digital tools or platforms do you use most often? (Please select all that apply) - - Interactive whiteboards (e.g. SMART Board) - Virtual labs or simulations - Video lectures and video materials - Interactive exercises or tests in e-platforms - Other
Advantages of use	What advantages do you see in using digital technologies in teaching STEM subjects? - Increase interactivity and student engagement - Improving access to up-to-date information resources - Convenience in organising and conducting classes - Increasing student motivation - Other
Challenges and difficulties	What are the main challenges you face when using digital technologies in teaching? - Are there any particular challenges or limitations you would like to highlight? - Technical problems when using a specific tool - Lack of support from the university administration - Lack of time to prepare and teach with the use of technology - Students' perception of digital technologies - Other
Outlook.	What prospects do you see for the further development of digital technologies in STEM education?

Source: compiled by the authors

3.4.3. Interview

Structured interviews were conducted with a focus group of participants who were willing to describe their own experience of using digital technologies in STEM education. This was done to gather an in-depth qualitative understanding of their experiences and opinions. The main interview questions focused on the learning process and perceptions. They are presented below:

Educational process

1. *How do digital technologies affect student engagement in STEM subjects?*
2. *Do you notice changes in students' learning outcomes due to the use of digital technologies?*

Perception

1. *Do your colleagues have positive or negative opinions about the use of digital technologies?*

3.4.4 Data analysis

Quantitative data were processed using descriptive statistics. At the same time, qualitative information is processed through thematic analysis, which is used to classify and interpret the data obtained during interviews and observations. Coding will be carried out independently by researchers to ensure reliability.

After that, the results of both quantitative and qualitative analysis will be integrated to provide a holistic understanding of the challenges and prospects of using digital technologies in STEM teaching.

4. RESULTS

The use of digital technologies in STEM education is a key element in improving the learning process and preparing students for the modern innovative world. These technologies facilitate active and engaging learning, promote the development of practical skills, and prepare students for the challenges of the modern scientific and technological environment. The average level of digital technology use among STEM teachers is quite high: 43 (65 per cent) use technology at grades 4 and 5 (see Table 4).

Table 4. Frequency of use of digital technologies and their evaluation

Assessment	Explanation	Number of people	%
1	I hardly ever use it	2	3,1%
2	I don't use much	6	9,2%
3	I use it on average	14	21,5%
4	I use a lot of	20	30,8%
5	I use it to the fullest extent	23	35,4%

Source: compiled by the authors

The use of digital technologies in STEM education is an important element for the development of an innovative learning environment. When asked what digital tools you use most often, 60 people answered that video materials and video lectures (92%). Most of all, modern teachers use interactive exercises and tests in electronic format - 63 people. This figure is the highest (98%). Other popular digital tools include interactive whiteboards, virtual laboratories and simulations, and virtual technologies. The results of this survey are presented in Table 5.

Table 5. Digital technologies in STEAM education

Title	Number of people	%
Interactive whiteboards and software	33 people	50,8%
Virtual labs or simulations	32 people	49,2%
Video lectures and video materials	60 people	92,3%
Interactive exercises or tests in e-platforms	63 people	98%
Virtual technologies (virtual tours and global access)	44 people	67,7%
Games in professional activities	23 people	35,4%

Source: compiled by the authors

Thus, video lectures and video materials are the most common, with 60 people using them. Interactive exercises and tests in e-platforms are also widely used. Modern digital tools allow

teachers to create electronic tests and assignments for student assessment. This facilitates the assessment process and allows for quick results.

At the same time, the Internet and digital technologies provide students with access to a large number of open learning resources that help expand their knowledge and understanding of concepts. Other popular digital tools include interactive whiteboards, virtual laboratories and simulations, and virtual technologies.

The use of interactive whiteboards and special software allows teachers to create dynamic and engaging lessons. Students can participate in answers, solve problems and interact with visualisations. Separately, digital technologies allow for the creation of virtual laboratories and simulations where students can conduct experiments safely and efficiently.

This is especially useful for subjects where access to real laboratories may be limited. On the other hand, with virtual technology, students can participate in virtual field trips to laboratories, businesses, and academic institutions from anywhere in the world. This facilitates global interaction and knowledge sharing.

At the same time, modern researchers prove that the use of gaming elements in STEM education can stimulate students' interest and motivation. Game-based approaches can be used to solve problems, learn concepts, and develop problem-based thinking. These technologies promote active learning, help develop practical skills, and prepare students for an innovative professional environment.

Teachers' responses to the question about the benefits of using digital technologies in teaching STEM disciplines show a variety of positive aspects that these technologies bring to the learning process. Figure 1 shows the main conclusions based on the answers provided.

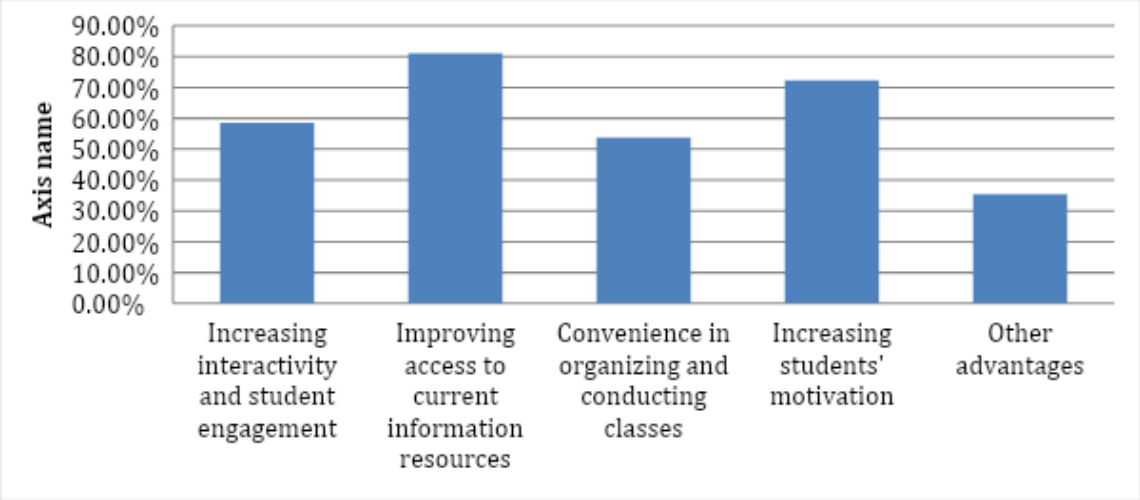

Figure 1. The main advantages of using digital technologies (based on the analysis of participants' responses). Source: authors' development

Below is an explanation of the identified benefits of using digital technologies in STEM education.

1. Increase interactivity and student engagement.

More than half of the teachers (58.5%) emphasised that the use of digital technologies contributes to increased interactivity in the classroom and active involvement of students in the learning process.

2. Improving access to relevant information resources.

More than 80% of teachers noted that digital technologies allow students to instantly access relevant information resources, which improves the quality of learning.

3. Convenience in organising and conducting classes.

More than half of teachers (53.8%) noted the convenience of organising and conducting classes thanks to digital technologies, which facilitates the teaching process.

4. Increase student motivation.

For 72.3% of teachers, the use of digital technologies helps to increase students' motivation to actively learn the material.

5. Other advantages.

Some teachers noted other benefits, such as the possibility of individualising learning, developing critical thinking and practical skills through the use of digital tools.

These aspects indicate that digital technologies in STEM education facilitate active, interactive, and effective learning, contributing to improved understanding of the material and student engagement in the learning process.

At the same time, the majority of teachers (68.5%) notice positive changes in students' learning outcomes as a result of the use of digital technologies. They emphasise that these technologies help to improve learning and active engagement with learning content. In particular, interactive exercises, video lectures, and the use of virtual technologies received positive feedback on their impact on students' understanding and interest in the subject. However, 31.5% of teachers have not noticed any significant changes in learning outcomes or believe that the impact of digital technologies is uncertain. Therefore, it is important to keep in mind that the effectiveness of digital technologies may depend on the specific teaching context and students' readiness to use them.

Nevertheless, teachers note several key challenges they face when using digital technologies in teaching. In particular, 49.2% of the respondents indicated difficulties related to limited access to the necessary technical infrastructure, which may limit the possibilities of introducing digital technologies.

This category also included the limited access of students to high-speed Internet and material and technical equipment of universities in the context of the pandemic and martial law in Ukraine. Under these conditions, infrastructure problems, such as the destruction of networks and Internet providers as a result of the hostilities, led to unstable Internet connections. The pandemic has also led to changes in the operation of university campuses, limiting access to computer laboratories and other logistical resources. Providing the necessary hardware and software has become more difficult due to limited financial resources and circumstances related to general instability and Russian aggression. The organization of distance education has become a challenge in an environment where access to technical facilities and the Internet is not guaranteed for all students.

36.9% of teachers noted problems related to the quality of the Internet connection, which may affect the smoothness and efficiency of using online resources. 29.2% of teachers feel that insufficient preparation for the use of digital technologies in teaching can be a significant challenge (see Figure 2).

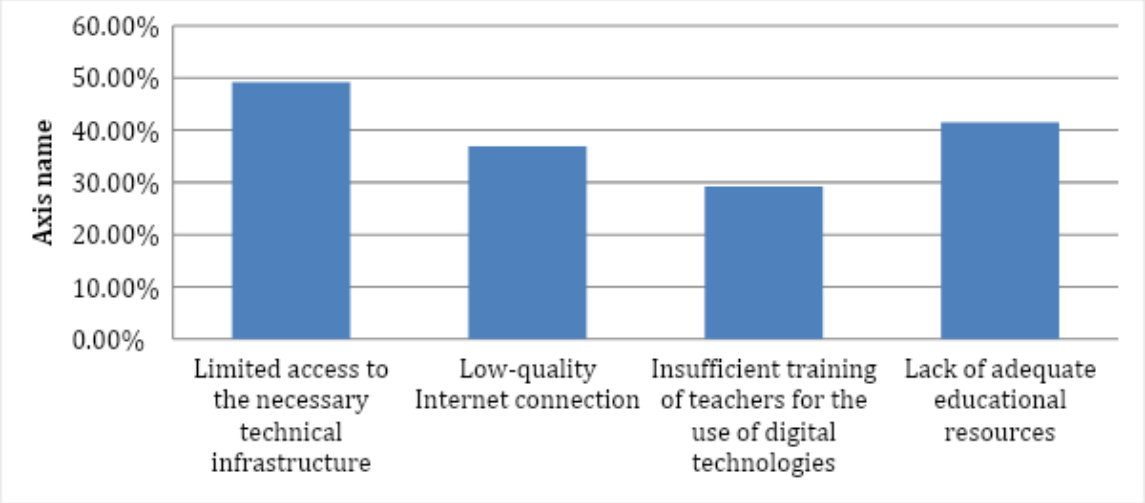

Figure 2. Challenges in the use of digital technologies in STEM education**.**
Source: compiled by the authors

In addition to this, teachers mentioned specific difficulties and limitations they experience. These included technical problems with using certain digital tools, lack of support from the school administration, or lack of time to prepare for teaching with modern digital facilities and tools (see Table 6).

Table 6. Practical difficulties

Additional difficulties	% of respondents
Technical problems when using a specific tool	26.2%
Lack of support from the university administration	18.5%
Lack of time to prepare and teach with technology	32.3%
Students' perception of digital technologies	24,6%

Source: compiled by the authors

Thus, these answers point to important aspects that should be considered when planning and implementing digital technologies in higher education. Therefore, the development of digital technologies in STEM education has a number of prospects that open up new opportunities for improving student learning and training. Table 7 shows the key prospects for further development of digital technologies in STEM education.

Table 7. Prospects for the use of digital technologies in STEM education

Outlook	Explanation
Development of virtual and augmented reality	With the help of virtual and mixed reality, students will be able to interact with three-dimensional objects and virtual environments, which will expand the possibilities of real-time learning
Developing new interactive platforms and tools	Modern technologies allow us to create learning environments that increase interactivity and student engagement in the learning process. The development of high-quality interactive platforms will allow teachers to create engaging lessons and effective teaching methods, and students to interact with the material in a more efficient way.
Increasing the availability of digital resources for teachers	This may include the creation of online libraries where teachers can find and use quality learning materials, as well as the development of tools for creating their own learning resources. Increasing the availability of resources will contribute to the more effective use of digital technologies in higher education.
Cooperation between universities and technology companies	This interaction allows universities to access advanced technologies and resources, facilitates the development of joint programmes and projects, and increases the relevance of the

	knowledge students receive. Technology companies can contribute to the development of STEM education by providing support and resources for learning, as well as helping to prepare students for the challenges of the modern labour market. Such cooperation promotes a harmonious merger of academic and practical experience, providing students with a high-quality and up-to-date education in STEM fields.
Strengthening cybersecurity and data protection	Development of technologies to ensure a high level of cybersecurity and privacy protection in the context of active use of digital platforms.

Thus, cooperation between universities and technology companies is a key factor for the successful implementation of digital technologies in STEM education. Another important area is the development of high-quality virtual laboratories and simulations for various STEM disciplines, which will allow students to gain practical experience without the limitations of real resources. At the same time, to successfully implement digital technologies in teaching, it is necessary to increase the availability of digital resources for teachers. These perspectives indicate that the development of digital technologies in STEM education is aimed at providing more effective, accessible, and innovative learning.

5. DISCUSSION

Thus, the article proves that the use of modern digital technologies significantly improves the development of STEM education. In the proposed empirical study (survey of teachers), positive changes in the education of students due to the active use of digital technologies are noted.

The study (based on the results of the survey) found that, in general, teachers recognise the important role of modern technologies that help improve learning and establish more active interaction with the learning content. First of all, it has been demonstrated that interactive exercises, video lectures, and the use of virtual technologies have extremely positive dynamics of use in teaching. However, it is also important to take into account that the effectiveness of digital technologies directly depends on the teaching contexts and the ability of students to use them adequately to their educational needs. This observation is also recognised as valid in the study by in which the researchers have formed a set of measures that need to be taken in order to achieve maximum learning benefits. It is also worth agreeing with the opinion of Deyoe, Newman, & Lamendola (2015) about the importance of pedagogical support for students in the integration of digital technologies into STEM education. In particular, timely pedagogical control will improve learning outcomes.

The results obtained indicate the existence of key challenges in the use of digital technologies in teaching. First of all, they pointed to the difficulties associated with limited access to the necessary technical infrastructure. The same conclusion was also reached by Hsu & Fang (2019), who identified the need to develop educational infrastructure in line with the growing demands of modern technologies. Therefore, this problem is quite relevant for solving in the future.

Instead, Ataeva (2022) identified the important role of philosophy in modern education. Certain comments on this concept can be found in this study. The interviewed teachers complained more about the practical aspects of using the achievements of digitalisation in modern teaching. In particular, they mentioned technical difficulties, lack of support from the university administration, lack of time, and problems with organising student work. Against this backdrop, none of the interviewed teachers mentioned the philosophical challenges of understanding the work with digital technologies, which could improve the overall understanding of the mechanisms of modern teaching. Therefore, it is practical rather than

theoretical challenges that are much more urgent to overcome. However, these findings can also be explained by certain limitations of the study.

The scientific novelty of the study includes several important aspects. In particular, the study examines in detail how digital technologies are used in teaching STEM disciplines, identifying new, effective methods and tools. Additionally, specific difficulties or challenges faced by teaching STEM using digital technologies (technical, pedagogical, administrative barriers) and prospects for further innovative development were identified. Another important aspect was the evaluation of the effectiveness of digital technologies in STEM education based on empirical research.

The use of the interview and questionnaire method in the study has its limitations. In particular, it is the influence of the interviewer on the answers, which can cause distortion of the results since each interviewer can influence the interlocutor in different ways. It is also worth noting that some respondents may be dishonest in their answers, or the influence of the interviewer may lead to socially desirable answers. The questionnaire method also has similar drawbacks. First of all, questionnaires may have a low response rate, especially if respondents are not interested in participating or do not understand the importance of the topic. Also, compared to an interview, a questionnaire limits the possibilities for a detailed explanation of the respondent's answers. Compared to other research methods, questionnaires may be less able to verify the reliability of answers. Therefore, both methods have their limitations that have a significant impact on the results. Obviously, taking these limitations into account can adjust future studies.

Given that digital technologies are constantly evolving. An urgent task for further research is to consider further digital evolution and its impact on the possibility of application in STEM education.

6. CONCLUSION

Thus, modern teachers actively use digital technologies in STEM education. The average level of digital technology use among STEM teachers is quite high: 43 people (65%) use technology at grade levels 4 and 5. However, such an active use of digital technologies in STEM education creates both challenges and opportunities. In particular, modern teachers often face limited access to the necessary technical infrastructure, which can limit their ability to implement digital tools.

Poor internet connectivity can affect the smoothness and efficiency of using online resources. Insufficient teacher training in the use of digital technologies is also a significant challenge. Most teachers note the need for additional training to effectively integrate these technologies into the learning process. However, along with these challenges, there are also broad prospects for further development.

Increasing the availability of digital resources for teachers will make teaching more accessible and variable. Cooperation between universities and technology companies also opens up new opportunities for the development of STEM education. This interaction facilitates the exchange of experience, access to advanced technologies and resources, and creates conditions for the implementation of joint projects and programmes.

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