Innovations in the Education of Future Teachers: Integration of Digital Didactic Tools in the Training of Primary Education Teachers

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Abstract

The aim of this paper is to analyse the current state and possibilities of integrating digital didactic tools—such as software applications with gamification elements, robotic and coding kits, and didactic toys based on STEM/STEAM principles—into the undergraduate training of primary education teachers. The study assesses the effectiveness of these tools in the educational process by analysing qualitative and quantitative results from domestic and international studies conducted within a European context. The research includes an analysis of data from various faculties of education that are progressively introducing digital technologies into curricula designed to prepare future teachers. Both domestic and foreign studies have demonstrated significant improvements in the cognitive and motivational abilities of primary education students when utilising tools with elements of gamification and AR/VR technologies. Based on the results obtained, this article proposes several recommendations for the effective implementation of digital didactic tools in teacher preparation. The conclusion underscores that the technological and digital readiness of future teachers is crucial for successfully meeting the demands of modern education and ensuring quality education for the next generation.

Keywords: Pre-service Teacher Training, Digital Didactic Resources, Pedagogical Innovation

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1 Introduction

Currently, education at all levels of schooling is in a period of intense innovation, responding to rapid technological advances and the changing needs of society (Buckingham, 2020). Especially in the field of primary education, new approaches to integrate digital didactic tools into the educational process are gradually emerging. For faculties of education in Slovakia, this means not only adapting curricula to modern requirements, but also effectively preparing future teachers to work with digital tools that support the development of children's cognitive and practical skills at an early school age. In this way, new conditions are created for the development of children's digital competences and technological thinking, contributing to their better preparedness for the needs of the current labour market and life in the digital era. Literature on this topic highlights specific resources such as software applications with gamification elements, robotic and coding kits, and didactic toys based on STEM/STEAM principles (Asad et al. 2021; Alrashedi et al., 2024). These tools help develop algorithmic and critical thinking, creative problem solving, and promote active participation of students in the learning process. The studies (Pridavková et al., 2023; Peykova, Garov, 2021) suggest that incorporating digital technologies and gamification into the learning process not only increases students' motivation but also contributes to improved academic performance and deeper understanding of the curriculum. In the foreign context, the implementation of these tools in schools and in teacher training has already been shown to yield positive results, but in the Slovak environment, this is an area that requires deeper analysis and adaptation to the specific conditions of our schools and teacher training.

This paper analyses the current state of integrating digital didactic tools into the undergraduate training of primary education teachers in Slovakia. We aim to address the following question: *How can the use of modern digital tools enhance the effectiveness of future teachers' education, and what is the potential of these technologies in teacher training?* Exploring this question may significantly influence the current approach to teacher education in Slovakia or confirm that modern technologies and didactic approaches can be effectively incorporated into the existing framework, thereby contributing to its further improvement. If these tools are successfully implemented, we can anticipate increased motivation and performance among students in STEM areas, which will also strengthen teachers' competencies and readiness to meet the demands of the digital era.

2 Theoretical Background

Integrating digital tools into teacher training fundamentally reshapes education to meet the needs of a digital society. Technologies like gamified apps, robotics kits, and augmented reality (AR) offer significant benefits for developing students' cognitive and practical skills (Black et

al., 2006; Buckingham, 2020). These tools enable educators to adapt learning experiences to various student needs.

One of the most prominent approaches is gamification, which integrates game elements such as rewards and competitions to increase student motivation and engagement in the learning process (Sylvester, 2024). The research on gamification in education highlights its considerable benefits for teachers, as it allows them to experiment with various pedagogical methods and assess their impact on student motivation and academic performance. According to the study titled *Latent factors on the design and adoption of gamified systems for education* (Doe, Smith, 2023), effective gamification design integrates educational, curricular, and technological principles that are crucial for fostering an engaging learning environment. The study emphasises that well-designed gamified applications significantly enhance student motivation, leading to increased engagement and potentially improved academic outcomes. This aligns with the broader understanding that gamification, when aligned with educational objectives and thoughtfully implemented, can serve as a powerful tool to enhance educational processes and outcomes.

Robotics and programming are other important components of modern education. Based on a study *The Significance of Training Student-Teacher Lecturers in Pedagogical Robotic and Coding Skills* by Mokonyane-Motha and De Jager (2023), it was found that teachers who were trained in robotics building blocks and coding not only showed higher readiness for technology instruction but also improved students' ability to master complex problems. Preparing future teachers to work with these tools promotes the development of algorithmic thinking and critical skills. These results are consistent with other research, such as the study by Jaipal-Jamani and Angeli (2017), which found that preservice teachers' self-efficacy and their understanding of science concepts significantly improved when they were trained in robotics and programming. This training also enhanced their computational thinking, further emphasizing the importance of integrating these technologies into teacher education programs.

Another important technological approach is the use of augmented reality (AR) in the educational process. In a study conducted in Slovakia, Pridavková and colleagues (2023) showed that the use of AR in mathematics education increases not only interest in the subject, but also understanding of complex concepts. Student teachers who had the opportunity to work with AR technology during their undergraduate education showed greater motivation and creativity in solving mathematical problems. In this way, AR technology creates an environment for interactive learning, which has a profound effect on students' ability to better retain and understand the material.

The literature also suggests that pre-service teacher education should include training in the use of STEM/STEAM toys and other didactic tools aimed at developing critical and spatial thinking skills. The study by Shukshina et al. (2021) suggests that STEM and STEAM frameworks can significantly foster problem-solving skills, critical thinking, and creativity

among students by incorporating practical, interdisciplinary approaches that connect scientific theory with real-world applications.

The importance of integrating digital tools into pre-service teacher training is therefore indisputable. Digital technologies offer a way to keep up with modern educational challenges and allow teachers to better prepare their students for the complex issues of today's world (Alrashedi et al., 2024; Black et al. 2006). The findings from these studies clearly indicate that effectively incorporating digital tools and methodologies into the preparation of future teachers can significantly impact their ability to lead classrooms in technologically challenging environments and effectively educate the next generation.

3 Current State of Knowledge

The study *Technology-Enhanced Education through VR-Making and Metaverse-Linking to Foster Teacher Readiness and Sustainable Learning* by Lee and Hwang (2022) investigates how pre-service English teachers can develop and implement technology-enhanced learning environments using Virtual Reality (VR) and integrate these experiences into metaverse platforms. This research equips future educators with the skills necessary to create engaging, adaptive, and sustainable educational settings. By employing a mixed-methods approach, the study gathers data through pre- and post-intervention surveys and reflective papers written by participants. Surveys are quantitatively analysed for statistically significant changes, while reflective papers provide qualitative insights via sentiment analysis and text mining. Results indicate significant enhancements in technological readiness, critical thinking, creativity, collaboration, and communication skills – the 4Cs of 21st-century skills. The findings highlight the pedagogical advantages of VR in creating interactive, engaging environments that support long-term knowledge retention and essential competencies.

An OECD report (2020) analyses the impact of the COVID-19 pandemic on education, with an emphasis on the technological readiness of schools and teachers in European countries. The aim was to identify the level of readiness for digital tools and to explore the need for further teacher training in digital skills. Methods included the use of data from several national surveys, questionnaires and interviews with school administrators and teachers. These methods provided insight into how schools were responding to distance education and what their technological capacity was. The results showed that approximately 65 % of schools in Europe showed increased preparedness to use digital technologies during the pandemic. Nevertheless, a large proportion of teachers felt the need for further training to help them use these technologies more effectively. The report's conclusion underlines that the pandemic has revealed significant gaps in teachers' digital training and highlighted the need for more intensive technology training during their undergraduate studies.

The study by García-Valcárcel and Tejedor (2009) examined the integration of information and communication technologies (ICT) into university teaching within the framework of the European Higher Education Area. The research aimed to explore how ICT tools are utilised in

higher education, the competencies teachers need to effectively use these technologies, and the challenges they face. The study used a descriptive methodology, gathering data through interviews with university lecturers from various disciplines at the University of Salamanca. The findings highlighted that most educators recognize the potential of ICT to enhance teaching and learning processes. However, the study also revealed significant barriers, such as insufficient technical infrastructure, lack of time, and limited training in pedagogical applications of ICT. Teachers emphasized the need for training that combines technical skills with methodological guidance to create meaningful learning experiences. The research underscored the importance of equipping educators with the knowledge to design and implement technology-supported learning environments, fostering collaboration and innovation.

In her study *Formation of ICT Competency of Future Teachers* Rahimova (2024) addresses the critical integration of Information and Communication Technology (ICT) into the training of future educators. Recognizing the growing demand for digital literacy in modern education, Rahimova focuses on enhancing the ICT competencies of teacher candidates. The objective is clear: to prepare future teachers to effectively navigate and utilise technology in their professional practices, ensuring they can meet the challenges of the information society. Rahimova employs a comprehensive analytical approach, examining the impact of various ICT tools and resources within educational settings. She evaluates how these technologies influence both the educational process and the development of professional competencies among students and educators. Her methodology involves not only the review of existing literature but also the analysis of pedagogical outcomes when ICT is integrated into teaching strategies. The results of the study underline the significance of ICT in education. Rahimova finds that embedding ICT tools in teacher training enhances the dynamism and relevance of the teaching process, aligning it more closely with contemporary educational needs. The study concludes that a strong ICT competency is essential for future teachers, as it directly affects their ability to foster an engaging and effective learning environment.

The study *Developing technological pedagogical content knowledge skills during teaching practicum* by Jaeni and Ghufron (2024) delves into how Indonesian pre-service teachers develop their technological pedagogical content knowledge (TPACK) skills during their teaching practicums. It seeks to explore the specific activities and strategies these future educators employ to enhance their TPACK competencies, as well as the challenges they encounter and how they overcome them. This inquiry is crucial for improving teacher training programs and ensuring educators are well-equipped to integrate technology into their teaching. Using a qualitative narrative inquiry approach, the research gathers insights from interviews with five pre-service teachers from diverse educational backgrounds. The analysis of these interviews helps to map out the strategies used by these individuals to develop their TPACK, such as observing veteran teachers, participating in educational workshops, studying relevant literature, and actively applying TPACK frameworks in their practicum activities. Despite their efforts, these pre-service teachers face several challenges, including limited

access to resources, low confidence in using technology, and inadequate time for reflective practice. To navigate these obstacles, they employ various adaptive strategies like collaborating with peers, engaging in reflective teaching, and setting clear, achievable goals for their practicum sessions. This study's findings highlight the importance of structured support and practical strategies in teacher training programs, suggesting that such elements are vital for preparing future teachers to effectively use digital tools in their educational practices.

The article *Teaching and learning natural sciences using augmented reality in preschool and primary education: A literature review* by Lampropoulos (2024) critically examines the impact of augmented reality (AR) tools on natural sciences education in preschool and primary settings. Lampropoulos aimed to gather and synthesize evidence on the effectiveness of AR in enhancing the understanding of scientific disciplines like Astronomy, Biology, Chemistry, Earth Sciences, and Physics among young learners. Employing a literature review methodology, he analysed 63 studies selected from various academic databases, focusing on those that specifically addressed the use of AR in early education. The results from this comprehensive review clearly demonstrated that AR tools not only boost student engagement and motivation but also lead to improved learning outcomes. Students exposed to AR showed better comprehension and retention of complex scientific concepts compared to peers taught through traditional methods. The study also highlighted that AR fosters an interactive and collaborative learning environment, which is crucial in making abstract scientific content more tangible and relatable to young students. By incorporating AR into teacher training programs, educators can be better prepared to leverage these technologies to enhance science education, making them invaluable tools for both teaching and learning in contemporary educational settings.

The 2017 study by Manning, Garvis, Fleming, and Wong titled *The Relationship Between Teacher Qualification and the Quality of the Early Childhood Education and Care Environment* delves into how teacher qualifications impact the quality of early childhood education and care (ECEC). Their research compiles and analyses empirical data from 1980 to 2014, using the Campbell Systematic Review methodology to critically evaluate the influence of educators' academic and professional credentials on the learning environments they provide. Essential to this analysis are metrics from the Early Childhood Environment Rating Scale, which assess the quality of ECEC through various dimensions, including program structure, activities, language development, and reasoning skills. The results underscore a clear and substantial link: higher teacher qualifications are strongly associated with better quality in ECEC settings. This finding highlights the indispensable role of well-qualified educators in elevating educational outcomes for young children. The implications of this study are significant, advocating for the integration of more advanced training and qualifications within teacher education programs. This is particularly crucial for equipping future educators with the competencies necessary to not only utilise digital tools effectively but also to create enriching and high-quality educational environments for early learners.

Jen Scott Curwood's study *Teachers as Learners: What makes technology-focused professional development effective?* delves into how digital tools are incorporated into professional development for English teachers, specifically examining how these practices affect their adoption of technology and teaching methods. The goal is to identify key elements that contribute to the success of professional development focused on technology integration and to explore effective implementation strategies. Methodologically, this research adopts a qualitative case study approach, involving English teachers and library media specialists from two high schools over a year. The process included observing and recording meetings of professional learning communities, conducting interviews, and analysing these interactions to gain insights into how digital tools are weaved into teaching practices. The findings reveal that successful technology integration hinges on creating and maintaining collaborative learning environments where teachers are actively using digital tools. Professional development programs that provide direct, hands-on experiences with technology, coupled with regular opportunities for reflection on teaching practices and ongoing support through peer dialogue, significantly boost teachers' readiness and enthusiasm to incorporate digital tools into their curriculum. This study underscores the importance of well-structured professional development in equipping future educators with the skills and confidence to seamlessly integrate technology into their teaching strategies.

The study Shukshina et al. (2021) focuses on identifying ways to integrate STEM and STEAM approaches into teacher education in Russia with the aim of modernizing their pedagogical skills and effectively utilizing digital didactic tools. The goal of the research is to explore opportunities to improve educational strategies so that future teachers can teach complex concepts in an attractive and interactive manner while also promoting creativity and critical thinking in students. The work proposes methodological innovations, including the inclusion of courses focused on the effective use of digital technologies in primary education. This modernization of curricula aims to equip future teachers with the skills needed to address current educational challenges and ensure that students acquire the skills necessary for the 21st century. In summary, the research emphasizes the need to update teacher education to include digital tools and STEM and STEAM approaches, focusing on preparing educators for a technology-driven and innovative educational environment.

The study *Teacher Perceptions of Barriers and Benefits in K–12 Technology Usage* by Carver (2016) focused on analysing the barriers and benefits of technology use in U.S. K–12 schools. The main goal was to determine what barriers prevent teachers from using technology effectively and what benefits it brings to their teaching. The research included surveys and interviews of teachers in a variety of schools, which provided both qualitative and quantitative data on teachers' experiences with technology. The researcher analysed this data to identify the major barriers and benefits that technology integration brings to K–12 education. The results showed that less than half of the teachers felt prepared to use technology effectively in the classroom. Major barriers included lack of technology training during pre-service education and limited access to technology in schools. However, teachers with sufficient

technology skills reported higher student engagement and better teaching dynamics when using technology. In conclusion, Carver (2016) recommends increasing teachers' technology preparation during their undergraduate studies so that they have a better ability to integrate technology into their teaching to maximize the benefits that modern technology brings to the classroom.

The study *Virtual Reality as a Pedagogical Tool to Enhance Experiential Learning* conducted by Muhammad Mujtaba Asad and colleagues (2021) explores the potential of virtual reality (VR) to transform experiential learning in educational settings. Aiming to evaluate the impact of VR on enhancing student engagement and understanding, the research utilises a systematic literature review methodology, analysing twenty-six peer-reviewed articles from various educational disciplines. The results indicate that VR significantly boosts student motivation and engagement, offering dynamic learning environments where theoretical knowledge can be applied in practical, simulated scenarios. This capability of VR to facilitate complex learning experiences, which are otherwise unfeasible in traditional classrooms, underscores its potential as a transformative educational tool. Integrating the insights it becomes evident that VR technology can play a crucial role in modernizing teacher education. By incorporating VR into teacher training programs, we can better equip future educators with the skills and understanding necessary to implement engaging and effective learning experiences using digital tools. Such an approach not only enhances the educational process but also prepares teachers to effectively utilise emerging technologies to foster a more interactive and immersive learning environment.

The study by Alrashedi et al. (2024) focuses on the role of gamified platforms in the training of future primary education teachers, specifically examining how these digital didactic tools enhance trainee engagement and motivation. The researchers adopted a quantitative methodology to measure the impact of gamification by conducting pre- and post-intervention assessments. Their findings highlight a significant increase in motivation and engagement among teacher trainees, who reported a greater interest in teaching and a stronger willingness to incorporate digital tools into their future teaching practices. The results suggest that gamified platforms can effectively create an innovative and interactive learning environment, essential for the evolving field of primary education. Conclusively, the integration of gamification in teacher training programs is seen as crucial in developing highly effective and motivated educators, preparing them to meet contemporary educational challenges and to foster an engaging learning environment for their future students.

The research titled *Educational Robotics for Elementary Students: Teaching's Opportunity* by Tira Nur Fitria (2024) focuses on the innovative integration of educational robotics into the curriculum for training primary education teachers. The study's objective is to evaluate the potential of educational robotics to enhance teaching methods, particularly in fostering computational reasoning and problem-solving skills among students. Employing a library research methodology, the study synthesizes data from a range of scholarly articles, journals, and books related to the application of robotics in educational settings. The findings suggest

that educational robotics not only enhances creativity and technological proficiency but also promotes collaborative skills and supports personalized learning experiences, especially for students with special needs. However, challenges such as the need for specialized teacher training and the integration of robotics into existing curricula are also identified. This research highlights the importance of incorporating advanced digital tools like educational robotics in teacher education programs to equip future educators with the necessary skills for the digital era.

The study *Digital Storytelling Skills of Teacher Education Students* (Cariño et al., 2024) explored the digital storytelling competencies of pre-service teachers at a Catholic university in the Philippines. The research aimed to assess the current level of these skills and propose strategies for improvement. Using a quantitative descriptive approach, the study evaluated third-year teacher education students through oral tests and analysed their proficiency in areas such as grammar, vocabulary, discourse, and technical skills. The findings revealed that most participants demonstrated a need for significant improvement in digital storytelling. The study also highlighted that there were no substantial differences in skill levels across different fields of specialization or academic majors. To address these gaps, the researchers proposed an intervention called *Project CLASS*, focusing on improving storytelling through guided listening and short storytelling sessions using digital tools. The study concluded that pre-service teachers require targeted support to enhance their digital storytelling abilities, which are crucial for modern educational practices in the digital age.

One of the relevant studies carried out in Slovakia, which focuses on the integration of digital didactic tools into the undergraduate preparation of primary education teachers, is the work of Pridavková and colleagues (2023) entitled *Analysis of students' work in the context of the inclusion of augmented reality technology in mathematics education*. The aim of this study was to investigate the impact of the implementation of augmented reality (AR) technology at the undergraduate level in mathematics education and to analyse student work before and after the introduction of AR technology. The research was conducted on a sample of 50 primary education teaching students who were divided into experimental and control groups. The experimental group used augmented reality during mathematics teaching, while the control group worked with traditional methods. The researchers collected data through analysis of student papers and questionnaires that assessed students' experiences and attitudes towards the use of AR in the teaching process. The results of the study showed that students from the experimental group showed a higher level of understanding of mathematical concepts and greater motivation to learn compared to the control group. Student work also indicated more creative approaches and deeper understanding of the curriculum, indicating the positive impact of AR on learning. Pridavková and colleagues (2023) concluded that incorporating augmented reality technology into pre-service teacher training can positively influence teachers' didactic skills and readiness to implement modern technologies in the educational process. The study provides valuable insights into the

effectiveness of AR in the preparation of future teachers in Slovakia and suggests the potential of this technology in improving the quality of education in primary schools.

3.1 Results of analyses of domestic and foreign studies

The analysis of the results of domestic and international studies suggests that the integration of digital didactic tools is essential for the quality undergraduate preparation of future teachers. Overall, three key areas of findings can be distinguished: the development of teachers' digital skills, motivation and engagement through gamification and VR, and the use of digital technologies in STEM education.

The first area – developing teachers' digital skills – includes the results of international studies that highlight the importance of technology-oriented professional development. Research by Curwood (2011) and a study by Carver (2016) show that technology-focused professional development is essential for future teachers because it enhances their ability to use technology effectively in the teaching process. For example, the TPACK model, tested in Indonesian (Jeani, Ghufron, 2024), has proven to increase teachers' confidence and readiness to work with digital tools. On the other hand, Slovak research (Pridavková et al., 2023) suggests that access to advanced technologies such as AR applications is limited, which hinders prospective teachers from gaining the necessary practical experience.

The second area – motivation and engagement through gamification and VR – is one of the key points of the international studies. Research by Alrashedi et al., (2024) and Asad and colleagues (2021) has shown that VR and gamified platforms can significantly increase prospective teachers' motivation and engagement in the teaching process. While gamification promotes interaction with content and creates a stimulating environment for learning, VR provides a safe environment for students to practice didactic skills and increase their confidence. However, there is still a lack of these technologies in pedagogical training in Slovakia, indicating gaps in access to innovative, practical methods that are more common abroad.

The third area – the use of digital technologies in STEM education – is particularly relevant in the context of developing the technical skills of future teachers. STEM-focused research, such as studies by Shukshina et al. (2021) and Peykova with Garov (2021), has shown that teacher preparation in programming and robotics can significantly improve teachers' ability to motivate students to solve complex problems and foster their technical thinking. However, this type of education is not yet sufficiently developed in Slovakia, suggesting the need to strengthen STEM training in faculties of education.

4 Conclusion and Recommendations

Based on the analysis of domestic and international studies, it appears that digital didactic tools have a significant potential to improve the quality of the preparation of future teachers.

Foreign research highlights those technologies such as virtual reality (VR), augmented reality (AR), gamified platforms, and specific professional development models such as TPACK are not only crucial for developing teachers' professional and technical skills, but also for increasing students' motivation to engage more actively in teaching (Alrashedi et al., 2024; Jeani, Ghufron, 2024). However, domestic research suggests that Slovak faculties of education face challenges related to limited access to these technologies, leading to lower preparedness of future teachers compared to their foreign counterparts (Pridavková et al., 2023).

The results of the analysis point to three main areas: the development of teachers' digital skills, motivation and engagement fostered through gamification and VR, and the use of digital technologies in STEM education. The first key area is digital skills development, which, as the international literature highlights, significantly supports continuous professional development. For example, research by Curwood (2011) confirms that professional development focused on digital competencies enhances teachers' ability to use technology effectively in teaching, which is essential for the quality of education. The TPACK model proved to be an effective tool in the Indonesian context for enhancing teachers' confidence and readiness to work with digital tools. The TPACK model (Technological Pedagogical Content Knowledge) provides teachers with a comprehensive framework that integrates technological, pedagogical, and content knowledge necessary for effective teaching using modern technologies (Jeani, Ghufron, 2024). However, Slovak research by Pridavková et al. (2023) points out that limited access to technology such as AR significantly reduces students' practical experience, which limits their readiness to teach in technologically challenging environments.

The second key area is motivation and engagement, which are supported by the use of gamification and VR. International studies show that VR and gamified platforms significantly increase student motivation and engagement in the learning process (Alrashedi et al., 2024; Asad et al. 2021). Gamification promotes interaction with learning content, while VR enables a safe environment for practicing didactic skills. However, technologies of this type are not widely available in pedagogical training in Slovakia, indicating a gap in the possibilities for practical application of these approaches.

The third area focuses on the use of digital technologies in STEM education, which is particularly crucial for developing the technical skills of future teachers. STEM-focused research, such as the work of Shukshina et al. (2021) and Peykova with Garov (2021), highlights that technologically prepared teachers in areas such as programming and robotics are better able to motivate their students and promote complex problem solving. These areas are less developed in the Slovak education system, suggesting the need to expand STEM training in pre-service teacher education.

The current approach to teaching digital competencies in foreign universities offers several advantages, including increased motivation, technical skills and confidence of future teachers. Interactive elements such as VR, gamification and AR provide opportunities to practice didactic skills and gain a deeper understanding of the learning content. Models such as TPACK

provide education faculty with a practical framework that integrates technological, pedagogical, and content knowledge, greatly enhancing the preparedness of future teachers. In Slovakia, however, the current approach faces constraints in access to technology and funding, which reduces the opportunities for future teachers to use modern digital tools in their practice.

The gaps identified suggest the need for greater investment in access to digital tools as well as systematic education in STEM, programming and robotics. Recommendations for further research include expanding domestic research on the long-term impact of digital didactic tools, particularly on the motivation and critical thinking of future teachers. Further research could focus on the effectiveness of implementing VR and AR in teacher preparation to understand their real benefits and potential challenges in practice.

Specific measures are proposed to improve the effectiveness and accessibility of teacher education in Slovakia. The first step should be to strengthen the technological infrastructure in faculties of education, thereby increasing future teachers' access to VR, AR and digital platforms. Furthermore, it is recommended to integrate STEM training and courses focused on programming and robotics into the teacher training curriculum, providing teachers with basic technical skills and an understanding of STEM education methods that promote analytical thinking. Introducing gamified elements into didactics and pedagogy teaching would also help to increase student teachers' motivation and improve their classroom management and teaching interaction skills. Finally, the focus should be on expanding professional development opportunities with an emphasis on digital skills, which would enable teachers to acquire up-to-date technical knowledge continuously and effectively.

The above measures can significantly improve the preparedness of future teachers for the demands of the modern learning environment and enable them to make better use of digital tools in primary education. Targeted investments in technological infrastructure and professional development could thus improve the overall quality of education in Slovakia.

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