DEVELOPING PROFESSIONAL COMPETENCE OF FUTURE PRIMARY SCHOOL TEACHERS USING INFORMATIONAL TECHNOLOGIES

DESENVOLVENDO COMPETÊNCIA PROFISSIONAL DE FUTUROS PROFESSORES DO ENSINO FUNDAMENTAL UTILIZANDO TECNOLOGIAS DA INFORMAÇÃO

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Abstract. The article focuses on studying the process of forming the professional competence of future primary school teachers using information technologies. Introducing information technologies into the educational process is integral to teacher training. The article examines various aspects of this process, including the selection of appropriate technological tools, methods of their use in the process, and practical teaching tools. The following methods were applied: questionnaires and surveys, observation and analysis of the educational process, and experimental research. The article presents the pedagogical technology of forming the professional competence of future primary school teachers using information technologies, considering the means and tools for forming this competence. Educational platforms and online resources, interactive whiteboards and software, digital tools for assessment and feedback, virtual tours and educational games, online communication and collaboration training, and professional development of teachers are distinguished among the tools for developing the professional competence of future teachers using information technologies. The dynamics of using information technology tools for forming professional competence of future primary school teachers from 2021 to 2023 is revealed. The study results conclude that using information technology in the learning process contributes to a more robust formation of professional competence of future primary school teachers, resulting in a higher quality of education.

Keywords: educational institutions, interactive teaching methods, professional competence, primary school teachers, information technologies, professional training.

Resumo. O artigo tem como foco estudar o processo de formação da competência profissional de futuros professores do ensino fundamental por meio das tecnologias de informação. A introdução de tecnologias de informação no processo educacional é parte integrante da formação de professores. O artigo examina vários aspectos deste processo, incluindo a seleção de ferramentas tecnológicas apropriadas, métodos de sua utilização no processo e ferramentas práticas de ensino. Foram aplicados os seguintes métodos: questionários e pesquisas, observação e análise do processo educativo e pesquisa experimental. O artigo apresenta a tecnologia pedagógica de formação da competência profissional de futuros professores do ensino fundamental por meio das tecnologias de informação, considerando os meios e ferramentas para a formação dessa competência. Plataformas educacionais e recursos online, lousas interativas e software, ferramentas digitais para avaliação e feedback, passeios virtuais e jogos educativos, treinamento em comunicação e colaboração online e desenvolvimento profissional de professores são distinguidos entre as ferramentas para desenvolver a competência profissional de futuros professores usando informação tecnologias. É revelada a dinâmica de utilização de ferramentas de tecnologia da informação para a formação da competência profissional dos futuros professores do ensino fundamental no período de 2021 a 2023.

Os resultados do estudo concluem que a utilização da tecnologia da informação no processo de aprendizagem contribui para uma formação mais robusta da competência profissional dos futuros professores do ensino básico, resultando numa maior qualidade de ensino.

Palavras-chave: instituições de ensino, métodos de ensino interativos, competência profissional, professores do ensino primário, tecnologias de informação, formação profissional.

1. INTRODUCTION

In modern education, information technologies play a crucial role in shaping the competence of future primary school teachers. Undoubtedly, society's interaction with technology is becoming more intense and inseparable each year. As a result, the demands on the professional training of educators focused on the successful use of modern educational tools are increasing. The relevance of forming professional competence of future primary school teachers through information technologies is determined not only by the rapid development of the technological sphere but also by the necessity of practical application of these tools in the educational process. Primary school teachers must have essential competencies in contemporary schooling and adapt flexibly to changing educational realities.

Studying and developing future primary school teachers' ability to use information technologies in their professional activities becomes crucial. After all, today's children are the children of the digital age, for whom interaction with technology becomes part of everyday life at an early stage of development. The effective use of information technologies in the educational process allows teachers not only to make lessons more engaging and accessible but also to ensure students' more profound understanding of the material. Therefore, research into the formation of professional competence of future primary school teachers through information technologies is a relevant and vital step in improving the quality of education and adapting the educational system to the demands of contemporary society.

Research Aim

This study is aimed at identifying effective methods and means of using information technology to develop approaches that will help future primary school teachers to effectively use information technology in educational practice to improve the quality of learning and student development.

Research Objectives

1. Exploring existing methods and approaches to using information technology in education.
2. Assessing innovative methods and educational programmes using information technology to develop the professional competence of primary school teachers.
3. Developing a pedagogical technology to form the professional competence of future primary school teachers using information technologies.
4. Investigating the dynamics of using information technologies to develop the professional competence of future primary school teachers, as well as identifying their potential for improving the quality of education in primary school.

2. LITERATURE REVIEW

The formation of professional competence of future primary school teachers using information technologies is a topical issue in pedagogical education (Baas et al., 2022), (Diaz et al., 2020). Many researchers emphasise the importance of integrating information technologies into the educational process to increase future primary school teachers' learning

effectiveness and competence development (Batsurovska, 2021), (Blau et al., 2020). Technologies can be used to create interactive lessons, personalise learning and motivate students (Björlin Svozil et al., 2020), (Castaño-Muñoz & Rodrigues, 2021).

The authors stress the importance of developing the skills of future primary teachers to work with information technologies (Palacios-Hidalgo & Huertas-Abril, 2021). It includes the ability to use different software tools, to adapt them for educational purposes, and to evaluate and select appropriate educational resources on the Internet critically (Hossain, 2023), (Žufić & Žufić, 2020). Some studies highlight the importance of practical experience in using information technologies in the educational process (Tudor, 2018), (Gunčaga et al., 2020).

Future primary teachers should be provided with opportunities for practical application of technologies in real educational situations, which will help them to acquire these skills more effectively (Landberg & Partsch, 2023), (Dotsenko et al., 2023). It is important to consider differences in students' needs and levels of preparation when using information technologies (Li et al., 2021), (Guo & Feng, 2021). Teaching should be adapted to the individual characteristics of each student, and teachers should be prepared to use technology for differentiated teaching (Li et al., 2024). To successfully integrate information technologies into the educational process, it is essential to provide teachers with support and assistance (Mebert et al., 2020). It can include training in specific technologies, advice on using them and sharing experiences with colleagues (Menezes et al., 2021).

Modern primary teachers should be able to apply various information technologies effectively in their work. It may include interactive whiteboards, software for creating educational materials, online resources for learning and much more (Mercader & Gairín, 2021), (Yuliandari et al., 2023). It is essential to provide future primary school teachers with appropriate training in information technologies. It can be integrated into the educational programmes of teacher training colleges or through special courses and training sessions (Schwartz & Minkov, 2023), (Pienimäki et al., 2021). An important aspect is the knowledge of technologies and the ability to apply them in teaching (Post et al., 2019).

Teachers need to develop children's digital literacy, helping them navigate the information space, analyse information and use technology to accomplish tasks (Kurent & Avsec, 2023). Information technologies allow teachers to individualise instruction based on the needs and characteristics of each student. It can be particularly beneficial in primary school, where the diversity of students' preparation levels and abilities is very high (Shalimova et al., 2022).

Overall, research and authors' perspectives emphasise the importance of information technology literacy among future primary school teachers and the need to integrate these technologies into the educational process, considering students' needs (Sun et al., 2023), (Akabayashi et al., 2023).

3. APPLIED METHODS

The study of forming the professional competence of future primary school teachers using information technologies includes various methods and approaches.

1. Literature review. Conducting a review of scientific literature on forming the professional competence of future primary school teachers using information technologies to identify current trends, methods, problems and approaches to this study.
2. Questionnaires and surveys. Conducting questionnaires or surveys among students of educational institutions that train future primary school teachers. The survey includes questions about their level of competence in information technology, how they perceive the importance of using information technology in the educational process, and how they assess the quality of training in this area.
3. Observation and analysis of the learning process. Observation of the educational process in educational institutions where future primary school teachers are trained to

identify how information technologies are used in teaching, how they affect the learning process, and how they form future teachers' professional competence.

4. Experimental research. Conducting experimental research allows for testing different methods and approaches to using information technologies in training future primary school teachers and evaluating their effectiveness in forming professional competence.

4. RESEARCH RESULTS

The professional development of future primary school teachers through information technologies plays a crucial role in the modern educational environment. Among the tools that can be used for this purpose are educational platforms and online resources, interactive whiteboards and software, digital tools for assessment and feedback, virtual tours and educational games, online communication and collaboration training, and teachers' professional development. Figure 1 shows the pedagogical technology used to develop the professional competence of future primary school teachers using information technologies. In the context of the proposed technology, the tools mentioned above and digital instruments for their implementation are presented.

Teachers can use different *online platforms and resources* to access educational materials, curricula, lessons, and tasks adapted to primary education. Such resources can help teachers to diversify their lessons and make them more interactive. For future primary school teachers, numerous educational platforms and online resources can help them develop their professional competence, including Coursera, edX, Khan Academy, Teaching Channel, PBS Learning Media and Google for Education.

The Coursera platform offers various education courses, including specialised courses for primary school teachers. For example, "Foundations of Elementary Education" or "Strategies for Teaching Reading and Writing". Similarly, edX offers online courses from universities around the world. Most education courses focus on different aspects of working with primary school students. The Khan Academy resource offers free educational materials in maths, reading, science, and other subjects that can be useful to primary school teachers in both lesson preparation and support for individual student learning. Teaching Channel offers video lessons and other resources created by teachers for teachers. Find lesson ideas, teaching methods and more.

The PBS LearningMedia platform offers educational resources, videos, lessons and games created by PBS staff and other organisations. It is an excellent resource for elementary teachers. Google offers many free educational tools and resources, including Google Classroom, Google Drive, Google Docs, and others, that can create interactive lessons and organise the learning process.

Interactive whiteboards and specialised software allow teachers to create engaging lessons with multimedia elements, interactive tasks, and games, facilitating students' better understanding of the material.

The use of interactive whiteboards and specialised software can significantly enhance the process of developing the professional competence of future primary school teachers. For example, interactive lessons and demonstrations, group work and discussion, creating original content and teaching digital skills can all be considered tools. Software such as SMART Notebook or Promethean ActivInspire enables the creation of interactive presentations in which students can participate by answering questions, completing tasks and interacting with the content. Interactive whiteboards allow students to collaborate on tasks and projects, sharing their thoughts and ideas. The software can provide tools for collaborative content creation and editing. Interactive whiteboard software typically allows for creating customised content, permitting teachers to tailor material to the needs of their class and teaching style. Interactive whiteboards and software also help future primary school teachers acquire digital skills that

they can integrate into their teaching practice. Teachers can use various digital tools *to assess and provide feedback to pupils*. These may include online tests, surveys, and homework submission platforms. Numerous digital tools, including Padlet, Socrative, Google Forms, Flipgrid, ClassDojo, and Seesaw, can be used for assessment and feedback to develop the professional competence of future primary teachers.

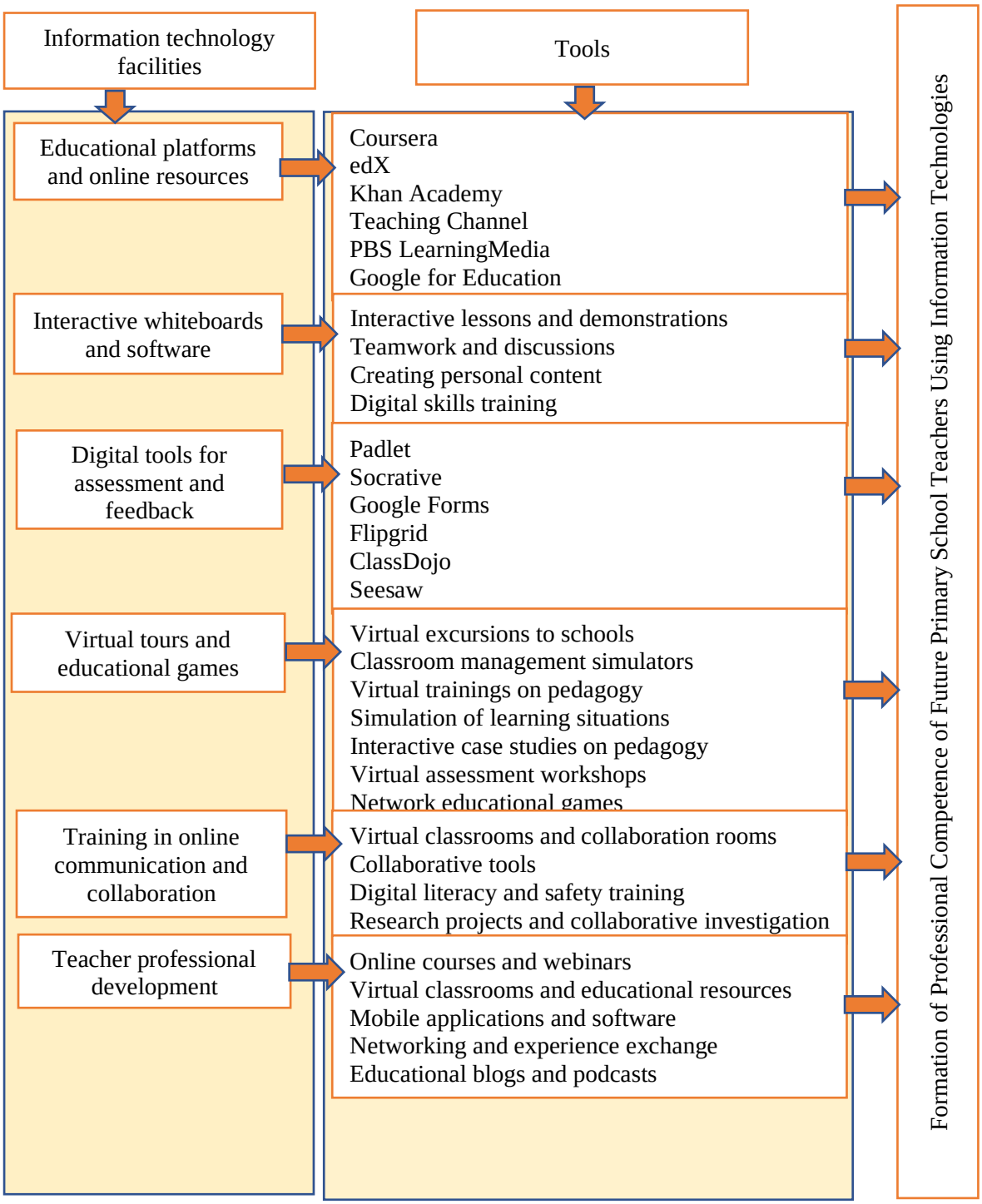


Figure 1. Pedagogical Technology of Forming the Professional Competence of Future Primary School Teachers Using Information Technologies
Source: author's development

The Google Forms tool allows teachers to create surveys and questionnaires to gather student, colleague, and management feedback. Teachers can use Google Forms to evaluate educational materials, teaching methods, and professional effectiveness. Padlet is an online board for sharing ideas, materials, and feedback. Primary school teachers can use Padlet to present educational materials, facilitate discussions, and collect student feedback.

Socrative allows the creation of tests and quizzes to assess student knowledge. Teachers can use Socrative for formative and summative assessment and to monitor student progress. The Flipgrid platform creates video responses and discussions. Teachers can use Flipgrid for oral presentations, idea sharing, and student feedback.

The ClassDojo tool tracks student behaviour and academic performance. Teachers can use ClassDojo to keep performance journals and interact with parents. The Seesaw platform is designed to create digital portfolios for students. Teachers can use Seesaw to track students' academic progress and provide feedback on their work.

Teachers can make the learning process more engaging and memorable for children through virtual field trips and educational games. These tools allow children to explore new topics and concepts interactively. Virtual field trips and educational games can be highly effective tools for developing the professional competence of future primary school teachers. These include virtual school trips, classroom management simulators, virtual pedagogical training, simulated teaching situations, interactive pedagogical case studies, virtual assessment workshops, and online educational games.

Virtual school visits allow future teachers to assist virtual classrooms in different schools, nationally and internationally. It helps them to learn about different teaching methods, familiarise themselves with different cultural contexts and develop strategies for working with different types of students. The development of educational games or virtual simulators will help future teachers learn classroom management, how to respond to unforeseen situations and how to apply discipline and motivation methods.

Virtual learning environments aim to create conditions where future teachers can participate in simulated lessons, analyse their actions, and receive feedback from experienced mentors. Developing virtual environments where future teachers can try different teaching methods, interact with virtual pupils, and optimise their teaching skills is an effective tool for simulating teaching situations.

Creating interactive scenarios in which future teachers can analyse complex real-life classroom situations and make decisions based on principles of pedagogical ethics and methodology is an effective tool for shaping the professional competence of future teachers. Developing environments where future teachers can learn assessment methods, conduct virtual exams and tests, and create online games where future teachers can collaborate with colleagues, share experiences and address everyday pedagogical tasks allows maximum immersion in a professional environment.

Teachers can use *online tools to teach students communication*, collaboration and teamwork skills. These essential skills will be helpful in both educational and professional settings. Teaching online communication and collaboration skills using information technology plays a crucial role in shaping the professional competence of future primary school teachers, namely virtual classrooms and collaborative workspaces; collaborative tools; digital literacy and safety learning; and research projects and collaborative research.

Creating virtual classrooms or collaborative workspaces is intended to enable pupils to interact with each other and teachers, discuss educational materials, develop projects and solve tasks. Using online collaborative tools such as Google Docs, Google Slides, online boards, file-sharing platforms, and others allows students to collaborate effectively on projects and assignments. Teaching students digital literacy skills, including critically evaluating information online, protecting their data and staying safe online, is a practical digital literacy

and safety tool. Supporting students in research projects using online resources and collaborating with other researchers and educators will help future primary school teachers develop the necessary skills for effective online communication and collaboration, making them successful in the modern educational environment.

Information technology can be used for *the professional development* of primary school teachers. Online courses, webinars, educational communities, and resources help teachers stay current with the latest educational trends and methods and share their experiences with colleagues.

The professional development of teachers using information technology plays a crucial role in shaping their professional competence, especially in training future primary school teachers. Tools that can be effective in this process include online courses and webinars, virtual classrooms and educational resources, mobile applications and software, networking and sharing of experiences, educational blogs and podcasts. Online learning platforms such as Coursera, edX and Udemy offer a wide range of courses on pedagogy, teaching methods and information technology in education. Teachers can take these courses to enhance their knowledge and skills.

There are many websites and platforms where teachers can find ready-made educational materials, interactive lessons and educational games to use in their classrooms, including Khan Academy, TED-Ed, Scratch and others. There are also many mobile apps and software developed specifically for educational purposes. These programs can help teachers create interactive lessons, assess student progress, and interact with parents. Social networks and online forums allow teachers to share experiences, ideas and resources. Platforms such as Twitter, Facebook, LinkedIn and specialised education forums can be valuable tools for professional development. Effective use of information technology in teacher professional development will help to better prepare future primary school teachers for the challenges of modern education.

Let us look at the dynamics of using information technology tools to develop the professional competence of future primary school teachers. We conducted a survey over three years (2021, 2022, 2023) among primary school teachers aged 25-55 and compared the results. The total number of respondents was 330. The data is presented below in the form of graphs (Figure. 2). Over the three years of the survey, respondents indicated which specific information technology tools they thought were most used and most effective in developing the professional competence of primary school teachers.

The number of respondents who indicated the effectiveness of using tools for teachers' professional development slightly increased, with 290 respondents in 2021, 310 respondents in 2022, and 300 respondents in 2023.

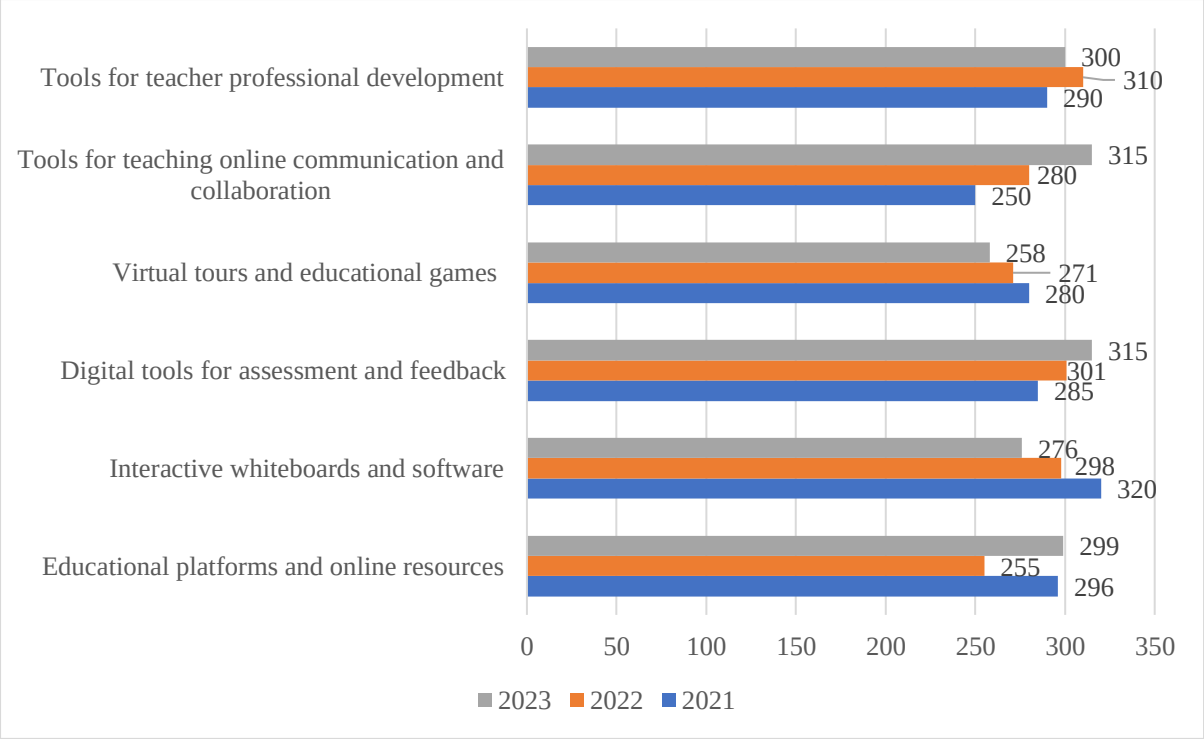
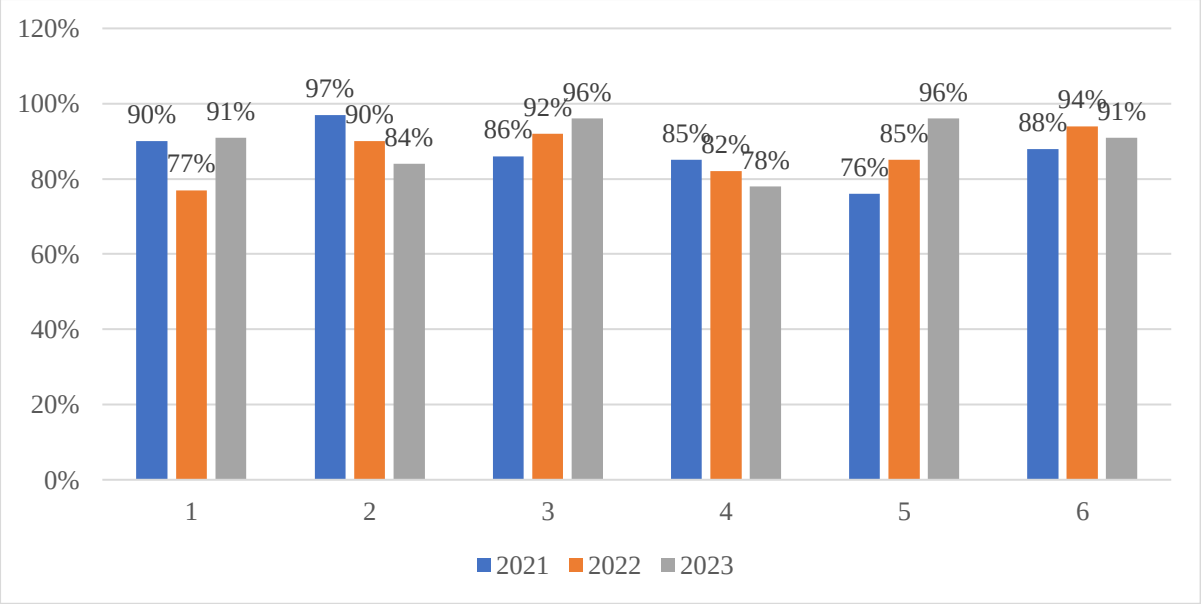


Figure 2. Dynamics of Using Information Technology Tools for Developing Professional Competence of Future Primary School Teachers from 2021 to 2023.
Source: author's development

The number of respondents who identified learning and online communication tools increased from 250 and 280 respondents in 2021 and 2022 to 315 respondents in 2023. The demand for virtual tours and educational games did not increase or decrease significantly, but the usage indicators were 258, 271 and 280 individuals out of 330 respondents. The effectiveness of digital assessment tools increased proportionally each year, with 285, 301 and 315 respondents, respectively, in the final year of the survey. The popularity of interactive whiteboards as a tool for developing the professional competence of future teachers decreased slightly from 320 in 2021 to 298 in 2022 and 276 in 2023, but these indicators are still high. Educational platforms and online resources remained virtually unchanged throughout the study period, with 296 respondents in 2021, 255 in 2022 and 299 in 2023.

The dynamics of studying the impact of using information technology tools for shaping the professional competence of future primary school teachers from 2021 to 2023 are presented in percentage terms in Figure 3. The use of online educational platforms remained practically unchanged throughout the study period, at around 90%, as did the use of tools for teachers' professional development, at 88%, 94% and 91%, respectively. Indicators for digital assessment tools and feedback development increased from 86% to 92%, and indicators for online communication tools grew from 76% to 96%. The indicators for interactive whiteboards decreased from 97% to 84%, and the indicators for virtual field trips declined from 85% to 78%.



1 - educational platforms and online resources, 2 - interactive whiteboards and software, 3 - digital tools for assessment and feedback, 4 - virtual tours and educational games, 5 - tools for teaching online communication and collaboration, 6 - tools for teacher professional development

Figure 3. Dynamics of Studying the Impact of Using Information Technology Tools to Develop the Professional Competence of Future Primary School Teachers from 2021 to 2023: Comparative Percentage Analysis.

Source: author's development

The decline in the indicators could be due to external factors such as the pandemic and full-scale intrusion. However, overall, the indicators are not critical and are mitigated by the increased use of other information technology tools. The high use rate of information technology tools to shape the professional competence of future indicators indicates the effectiveness of using the proposed technology.

5. DISCUSSIONS

Shaping the professional competence of future primary school teachers using information technology is a relevant and vital task in modern education (Wang et al., 2022). However, in the context of shaping the professional competence of future primary school teachers through information technology, there are many challenges.

Many primary school teachers may need more experience in information technology. They may need more knowledge and the confidence to use modern technology in the educational process. Not all schools have enough computers or other equipment to give every pupil access to technology. It can limit the ability of teachers to integrate information technology into the learning process. There is a need to develop courses or lessons that meet the needs of students and teaching standards, as well as integrate information technology. It requires time and effort in planning and producing quality materials. Information technologies constantly evolve, so teachers must continually update their knowledge and skills to keep abreast of the latest trends and best practices. Information technology in the educational process can raise questions about the security and confidentiality of students' data. Teachers need to be prepared to ensure technology's safe and secure use. Information technology can increase student motivation but can pose additional challenges in classroom management and keeping students focused on assigned tasks. Addressing these challenges requires a comprehensive approach, including

teacher training, access to resources, support from school management and the development of appropriate strategies for integrating technology into the learning process.

Information technologies can also assess student performance and provide feedback more effectively. It can include online testing, electronic portfolios, and electronic grade book systems (Okitsu et al., 2023). It is also important to consider potential barriers to the successful integration of information technology in primary education, such as access to appropriate hardware and software, as well as administrative and parental support (Kirinić et al., 2023), (Špernjak & Šorgo, 2018). This discussion allows us to identify both the advantages and challenges of using information technologies in shaping the professional competence of future primary school teachers, as well as to discuss ways to overcome them effectively.

6. CONCLUSION

The professional development of future primary school teachers using information technology is a crucial aspect of modern education. Information technologies enrich the educational experience of pupils, making learning more interactive and accessible. Primary school teachers should have the skills to use different tools to teach successfully in the modern digital educational environment. Information technologies can make learning more engaging and attractive for children. Interacting with interactive educational resources, games, and programmes motivates students to participate actively in the learning process.

The use of information technologies in education contributes to the development of information literacy, critical thinking, collaboration and communication skills, which are necessary for successful adaptation to the changing conditions of the modern world. Future primary school teachers must receive adequate professional training in using information technologies in the educational process. It includes practical skills in working with specific educational tools and understanding their methodology and pedagogical approaches. The development of information technologies creates new opportunities and challenges in education. Future teachers must be prepared to adapt to changing technological demands and integrate new methods and tools into their practice. Overall, the development of the professional competence of future primary school teachers through the use of information technologies requires a comprehensive approach that includes both technical aspects of working with information technologies and pedagogical principles and teaching methodology.

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