



Revista on line de Política e Gestão Educacional
Online Journal of Policy and Educational Management



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PRIMARY SCHOOL TEACHERS OF DIGITAL ERA: CHALLENGES AND PROSPECTS OF PROFESSIONAL TRAINING

PROFESSORES DO ENSINO FUNDAMENTAL NA ERA DIGITAL: DESAFIOS E PERSPECTIVAS DA FORMAÇÃO PROFISSIONAL

DOCENTES DE EDUCACIÓN PRIMARIA EN LA ERA DIGITAL: DESAFÍOS Y PERSPECTIVAS DE LA FORMACIÓN PROFESIONAL

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How to reference this paper:

Vasylykiv, I., Zhyhaylo, O., Ilyash, S., Kalyta, N., & Lutsiv, S. (2025). Primary school teachers of digital era: challenges and prospects of professional training. *Revista on line de Política e Gestão Educacional*, 29(00), e025021. 10.22633/rpge.v29iesp1.20426

Submitted: 25/05/2025

Revisions required: 12/06/2025

Approved: 05/07/2025

Published: 22/07/2025

ABSTRACT: The article analyzes the role of information technologies in the training of future primary school teachers within the framework of the New Ukrainian School (NUS). Based on scientific literature and empirical data, the research shows that integrating specialized digital tools significantly enhances teachers' professional competence, particularly in inclusive education. Methods such as factor analysis and scientific abstraction were used. The findings highlight the need for more practical training supported by tutoring to ease new teachers' adaptation. The study also points to the potential of immersive technologies and proposes the development of universal digital platforms for ongoing professional development in the current educational context.

KEYWORDS: Digital literacy. Pedagogical competence. Inclusive education. Multimedia learning. Educational platforms.

RESUMO: O artigo analisa o papel das tecnologias da informação na formação de futuros professores do ensino primário no contexto da Nova Escola Ucrâniana (NUS). A pesquisa, fundamentada em literatura científica e dados empíricos, demonstra que a integração de ferramentas digitais especializadas contribui significativamente para o desenvolvimento da competência profissional docente, especialmente na educação inclusiva. Foram utilizados métodos como análise fatorial e abstração científica. Os resultados apontam para a necessidade de uma formação mais prática, com apoio por tutores, visando facilitar a adaptação dos novos professores. O estudo destaca ainda o potencial das tecnologias imersivas e propõe a criação de plataformas digitais universais para formação contínua no contexto educacional contemporâneo.

PALAVRAS-CHAVE: Literacia digital. Competência pedagógica. Educação inclusiva. Aprendizagem multimídia. Plataformas educativas.

RESUMEN: El artículo analiza el papel de las tecnologías de la información en la formación de futuros docentes de educación primaria en el contexto de la Nueva Escuela Ucrâniana (NUS). Basada en literatura científica y datos empíricos, la investigación demuestra que la integración de herramientas digitales especializadas mejora significativamente la competencia profesional docente, especialmente en el ámbito de la educación inclusiva. Se utilizaron métodos como el análisis factorial y la abstracción científica. Los resultados indican la necesidad de una formación más práctica con apoyo de tutoría para facilitar la adaptación de los nuevos docentes. El estudio también destaca el potencial de las tecnologías inmersivas y propone la creación de plataformas digitales universales para la formación profesional continua en el contexto educativo actual.

PALABRAS CLAVE: Alfabetización digital. Competencia pedagógica. Educación inclusiva. Aprendizaje multimedia. Plataformas educativas.

Article submitted to the similarity system



Editor: Prof. Dr. Sebastião de Souza Lemes

Deputy Executive Editor: Prof. Dr. José Anderson Santos Cruz.



INTRODUCTION

The relevance of the study is determined by fundamental changes taking place in the field of teacher education under the influence of the digitalization of society and the transformation of educational approaches aimed at training highly qualified specialists capable of working effectively in the conditions of the New Ukrainian School. In the context of educational reform in Ukraine, particularly the concept of the New Ukrainian School, it is important to take into account the specific characteristics of the national teacher training system. According to the Ministry of Education and Science of Ukraine, as of 2024, more than 70% of teacher training institutions have integrated digital educational technologies into their curricula. However, about 40% of graduates of teacher training faculties lack practical skills for working in a digital classroom, which necessitates updating the content of future teachers' training to take into account the realities of the digital environment and inclusive education.

Today, it is extremely important to introduce innovative digital solutions into the educational process, which not only optimize pedagogical activities, but also develop in future primary school teachers the ability to quickly adapt to changes, think critically, reflect, and communicate in a constantly evolving interactive environment (Aristin et al., 2023). These arguments will serve as a basis for future teachers to effectively master the teaching material and improve their proficiency in modern teaching methods for primary school students, taking into account their individual needs (Makedon et al., 2020). In addition, there is a growing need to develop digital competence as an integral part of the professional identity of future primary school teachers.

Literature Review

An analysis of contemporary scientific discourse on the role of information technologies in the professional training of future primary school teachers indicates a high level of interest among researchers in rethinking pedagogical approaches in the context of the digitalization of the educational environment. A number of scientific works emphasize the need to integrate digital educational solutions as a key factor in the qualitative transformation of the educational process. Thus, according to Makedon and Ilchenko (2021), Terzi et al. (2022), the development of modern educational programs requires the use of information and communication technologies not only as an auxiliary resource but as an integrated part of the educational environment.

Criollo-C et al. (2021) contributed to the study of the relationship between digital tools and the development of teachers' professional competencies, focusing on the potential of mobile learning technologies for developing independence, communication skills, and

professional reflection in future teachers. For their part, Gallagher and Savage (2023) focus their literature review on the impact of challenge-based learning, which stimulates creativity, problem-solving skills, and active content acquisition through digital tools.

Research by Demitriadou et al. (2020) and McMurtrie (2021) confirms the effectiveness of using virtual and augmented reality in teaching mathematics in primary school, which is particularly valuable in preparing teachers to work in an innovative educational environment. Their findings indicate an increase in student motivation and improved learning outcomes. Haleem et al. (2022) and Jeon and Lee (2023) summarize current approaches to the use of digital technologies in education, emphasizing their role in ensuring sustainable educational development, especially in crisis situations. At the same time, Gao et al. (2023) investigate the motivational effect of virtual modeling, which can be adapted to the needs of teacher education in order to stimulate the cognitive activity of future teachers.

Important attention is also paid to the aspect of tutoring as a form of personalized student support. In this context, it is worth mentioning the study by Hosen et al. (2021), which highlights the impact of social networks on knowledge sharing and learning efficiency. The authors argue that digital communication platforms are an essential tool for informal education, contributing to the formation of communities of practice among future teachers.

Aristin et al. (2023) focus on the problem of student retention in distance learning, emphasizing that technological support can minimize the loss of academic motivation, especially in the face of global challenges. This correlates with the findings of Susanti et al. (2023), who point to the importance of the teacher's role as a facilitator in the online environment. In general, it has been found that the current scientific literature predominantly states the need for a systematic update of the methodology of professional teacher education with a focus on digital competencies, covering not only technical knowledge but also the ability to effectively use information technologies in the context of inclusive, differentiated, and interactive learning (Cook-Sather, 2020; Lo et al., 2024).

The approaches to digitizing teacher education described above, in particular mobile learning models, problem-based learning, and the use of virtual reality, form the basis for developing a model for training Ukrainian teachers that combines flexibility, interactivity, and adaptability. The outlined methodologies fit into the concept of the New Ukrainian School, which focuses on person-oriented learning, inclusiveness, and the development of digital competencies. The application of such approaches in Ukrainian pedagogical universities can contribute to the creation of an effective model of professional training that takes into account both international experience and national challenges of educational transformation.

The aim of this article is to explore the prospects of combining specialized digital solutions for high-quality and modern training of future teachers for work in primary schools.

RESEARCH METHODS

The study was conducted using a descriptive approach that combines analysis of scientific literature and empirical data to examine the role of information technologies in the professional training of future primary school teachers. The aim was to assess the potential of digital tools in shaping professional competencies in line with the concept of the New Ukrainian School. The literature review was based on scientific publications selected from the Web of Science and Scopus scientometric databases using the following keywords: primary school, professional education, Ukrainian school, digital technologies, inclusive education, and professional competence. The sources were analyzed using content analysis and comparative analysis, which allowed us to identify key trends and differences between national and international practices.

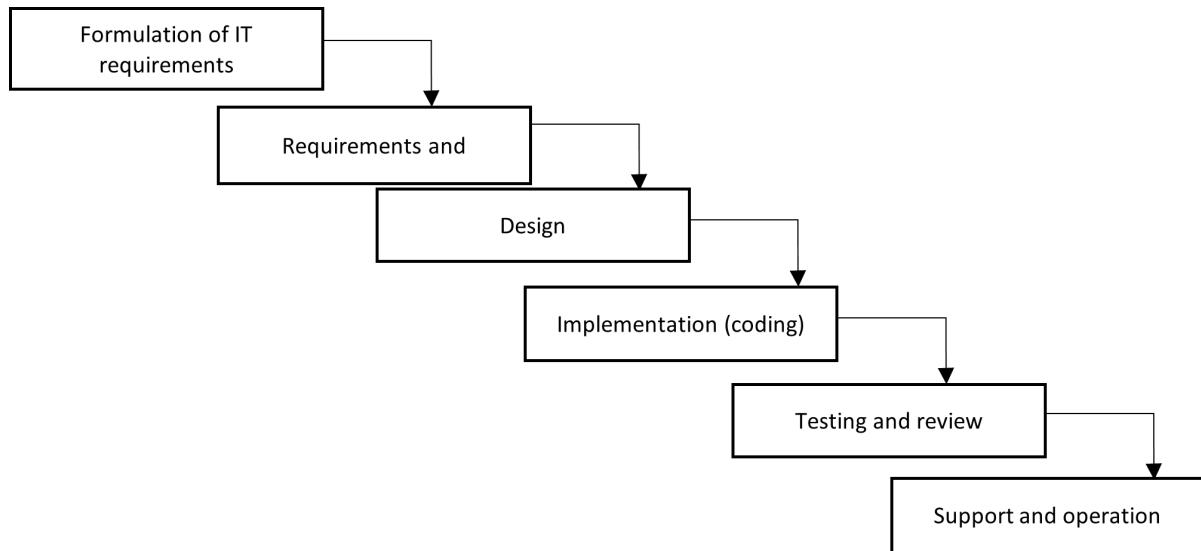
In addition, to summarize the results, we used a method of systematization and classification of empirical data based on the digital tools used, types of pedagogical interaction, and levels of digital competence. In addition, official statistical data, including reports on the implementation of the New Ukrainian School, were used to ensure the objectivity of the analysis. Comparative analysis was used to systematize approaches to optimizing professional training and identifying key influencing factors. The structural-logical method helped to develop practical recommendations, while the methods of deduction and scientific abstraction contributed to the formation of conclusions in the context of the digital scientific and communication environment.

RESEARCH RESULTS AND DISCUSSION

The role of digital learning tools in training teachers for primary schools

Within the modern educational paradigm, the key strategic guideline is the holistic development of the student's personality, which, in turn, requires future primary school teachers to have not only deep professional knowledge, but also to integrate such characteristics as ethical maturity, aesthetic sensitivity, the ability to critically analyze information, the ability to engage in creative pedagogical interaction, and continuous professional self-improvement. However, the fragmentation of the traditional methodological model of teacher training, which is mainly focused on reproducing knowledge within specific disciplines, significantly complicates the transfer of acquired knowledge to interdisciplinary and applied contexts, which is particularly problematic in a dynamic information society that requires flexible and comprehensive competencies, particularly with regard to working in an inclusive environment (Eker & Eker, 2023; How et al., 2024) (Figure 1).

Figure 1. Stages of creating and implementing digital teaching practices in teacher training for primary schools



Source: developed by the authors

These principles include, in particular, the need for a harmonious combination of different forms of learning, educational methods, and tools that contribute to the development of key professional competencies; the integration of interdisciplinary links to form a holistic pedagogical worldview; the dominance of a practice-oriented component in the educational process, which brings the content of education closer to the real challenges of the profession; and the active introduction of innovative digital technologies into the process of modeling pedagogical situations (Gruenewald, 2003; Naji et al., 2020).

In the context of educational reform, future teachers must not only master traditional forms of educational interaction, but also actively implement modern multimedia tools that enable the creation of a dynamic educational space with expanded opportunities for personalized and interactive learning (Kikas et al., 2024). The concept of Ukrainian school development clearly emphasizes the need for primary school teachers to develop high adaptability, the ability to respond quickly to changes, update their methodological arsenal, and initiate innovative educational practices that combine the features of traditional and digital education (Gronau et al., 2020) (Table 1).

Table 1. Use of information technologies in the professional training of future primary school teachers in Ukraine, % of students (in 2021–2024)

Digital learning technology	2021	2022	2023	2024
Online courses and webinars	20%	28%	35%	42%
Interactive training simulators	10%	15%	22%	30%
Cloud services for collaboration	25%	32%	40%	48%
Digital tools for inclusive education	12%	18%	26%	35%

Source: Ministry of Education and Science of Ukraine (2025).

The integration of modern information technologies into vocational education involves not only access to a wide range of digital resources, but also the active participation of learners in the creation of new educational products, communication in the digital environment, and the critical selection of content for their learning trajectory, which is particularly important for future primary school teachers (Mohamed et al., 2021). However, there is also an objective problem: the content of professional training does not meet the current requirements of the labor market.

Applied digital programs and platforms in the professional training of primary school teachers

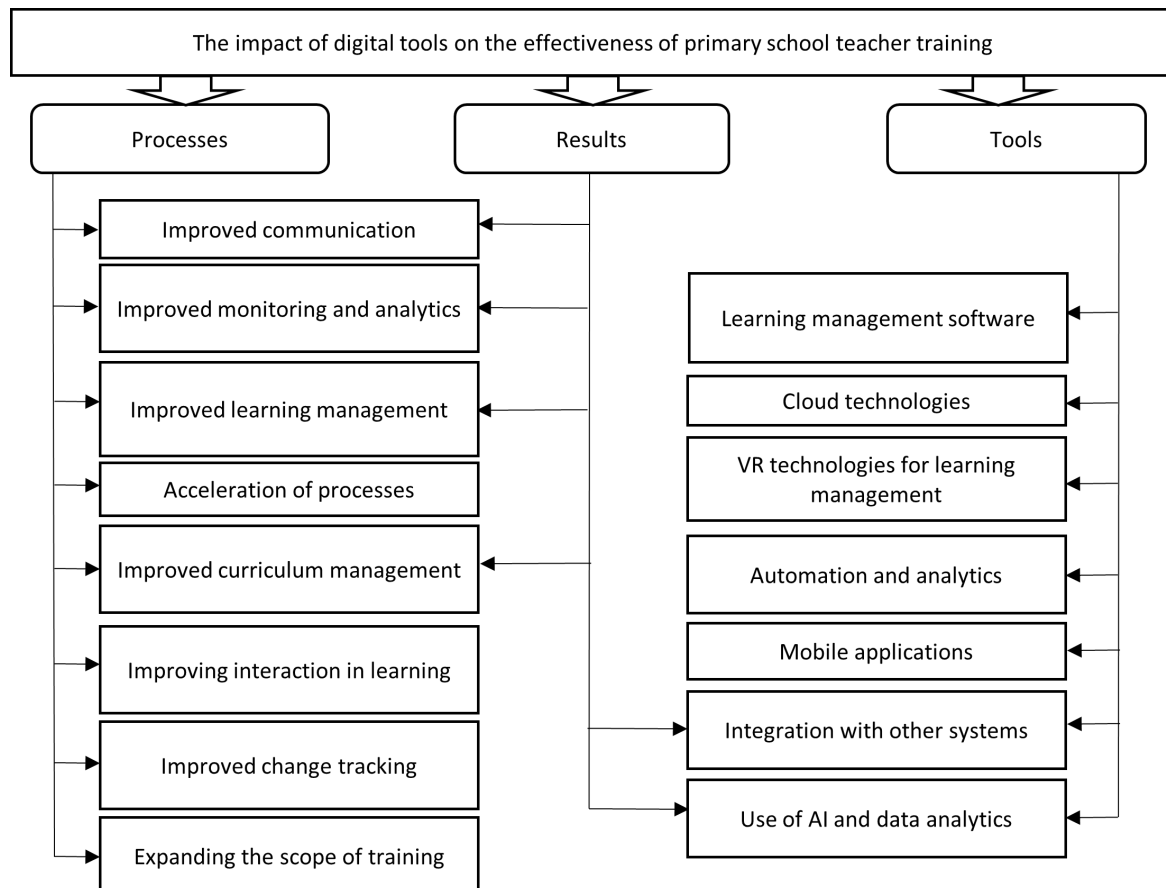
In the current context of digital transformation in education, the introduction of targeted approaches to strategic planning for the development of general secondary education institutions, particularly primary schools, is becoming increasingly important. In this context, the introduction of a balanced system of indicators that can be adapted to assess the quality of educational services, professional development of teachers, and the effectiveness of management decisions in schools is becoming a key component (Mykytyn et al., 2024) (Figure 2).

In the vocational education system, the processes of introducing digital information technologies are becoming increasingly important, as they support the entire cycle of pedagogical management, from strategic planning of the educational trajectory and its detailing at the level of practical tasks and goals to monitoring achievements and analytical assessment of professional growth (Voznyuk et al., 2022).

The results obtained after the study confirm the position of authoritative scientists who consider the digital transformation of professional training for future primary school teachers to be a key requirement of modernity. In particular, the established increase in the effectiveness of the development of pedagogical competencies through the use of digital tools is reflected in the works of Criollo-C et al. (2021), which emphasize the role of mobile learning in the formation of reflexivity, independence, and communication skills. The results concerning

increased motivation through the use of interactive technologies are also consistent with the findings of Gallagher and Savage (2023), who demonstrate an increase in student interest when innovative methods and digital learning environments are introduced.

Figure 2. Support for the full cycle of professional training for primary school teachers



Source: developed by the authors.

At the same time, the study partially refutes traditional notions about the adequacy of classical teacher training methods. For example, it was found that insufficient integration of digital solutions reduces the readiness of future teachers to work in inclusive classrooms and apply modern educational practices. This trend is consistent with previous studies by Haleem et al. (2022) and Jeon and Lee (2023), which justify the need to review methodological approaches in the context of technological changes and challenges.

The study should provide examples of the practical implementation of digital tools in teacher training institutions in Ukraine. For example, Drohobych State Pedagogical University has successfully introduced a course on “Information and Communication Technologies in Education” using the Moodle platform, which has made it possible to organize an adaptive learning environment for students. The National Pedagogical University named after M. P.

Dragomanov also tested a module entitled “Use of Cloud Technologies in Primary School,” which contributed to the development of practical skills in digital communication and collaboration.

A pilot project using virtual reality to model pedagogical situations was also successful, significantly increasing students’ readiness to work in an inclusive digital classroom (Ministry of Education and Science of Ukraine, 2025). The proposed areas for improving the professional training of future teachers can be implemented through the phased introduction of experimental educational modules that combine traditional disciplines with digital practices. In addition, the creation of tutoring support and feedback mechanisms in the digital environment will allow for the systematic integration of new practices into educational policy and professional training standards for teachers.

FINAL CONSIDERATIONS

The study found that effective training of future primary school teachers, when the education system is undergoing rapid change, should be based on a combination of proven traditional teaching methods and the latest innovative approaches. The study highlights the importance of introducing digital information technologies that help shape a holistic pedagogical view of the world, promote critical thinking, creativity, and readiness to work in an inclusive environment. The role of the practical use of advanced digital tools in professional training is analyzed with the aim of quickly forming and developing key professional skills and abilities of future teachers.

The feasibility of introducing information systems designed to manage the effectiveness of the educational process into the professional training system for future school teachers has been proven. Based on strategic planning and tactical implementation of educational goals, a model has been created that covers the entire process of professional development. The model allows for a “fluid” assessment of learning outcomes, enabling the quick identification of difficulties, timely adjustments to the training process, and regular feedback.

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CRediT Author Statement

Acknowledgements: None.

Funding: None.

Conflicts of interest: None.

Ethical approval: Not required to submit to ethics review.

Data and material availability: None.

Authors' contributions: The authors participated in different ways in the process of planning, carrying out, and analyzing the research and, at a later stage, in the construction of the report and, finally, in the systematization of this article. Each brought their respective academic expertise to the study.

Processing and editing: Editora Ibero-Americana de Educação

Proofreading, formatting, standardization and translation

