THE USE OF DIGITAL TECHNOLOGIES IN DEVELOPING THE PROFESSIONAL COMPETENCIES OF FUTURE TEACHER-EDUCATORS

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Abstract: In the modern era of rapid technological advancement, the integration of digital technologies into educational systems has become an essential factor in improving teaching and learning outcomes. This article explores the role and effectiveness of digital tools and platforms in enhancing the professional competencies of future teacher-educators. The study investigates how digital technologies contribute to the development of pedagogical skills, subject-matter expertise, digital literacy, and innovative teaching strategies among pre-service educators. By analyzing current practices, challenges, and benefits of digital integration in teacher training institutions, the article provides a comprehensive understanding of how technology can transform traditional teacher education programs into more dynamic, interactive, and learner-centered environments. Emphasis is placed on the necessity of equipping future educators with digital competencies that align with 21st-century educational standards and the global demand for digitally literate teaching professionals.

Keywords: Digital technologies, teacher-educators, professional competencies, teacher training, educational innovation, pre-service teachers, digital literacy.

Introduction. The transformation of education through digital technologies has redefined the expectations placed upon modern educators. In particular, the preparation of future teacher-educators – those responsible for nurturing and guiding the next generation of students – must now encompass a deep understanding and effective use of digital tools. With the advent of the Fourth Industrial Revolution and the increasing digitization of all aspects of life, the educational sector faces both an opportunity and a challenge: to equip future educators with the competencies required not only to function in a digital environment but also to innovate and lead within it.

Professional competencies of future teacher-educators are no longer confined to traditional pedagogical methods and content knowledge. Today, these competencies include the ability to design and deliver digital learning experiences, evaluate digital content critically, utilize online assessment tools, and foster collaborative learning through digital platforms. Integrating these skills into teacher education curricula is

essential for ensuring that pre-service educators are adequately prepared for the realities of modern classrooms.

In the development of the digital society, the professional preparation of future specialists should be based on knowledge relevant to sectors influenced by technological production and the laws governing society. It is essential to prepare them on the basis of such knowledge. In the modern educational environment, the development of mechanisms, tools, and technologies for training teachers who possess digital competence has become a pressing issue. Consequently, it highlights the necessity of understanding, from a scientific perspective, the essence of preparing teachers with a high level of digital competence in this field of activity.

The term "digital" originates from Latin and English, specifically from the word “digital,” and refers to “data or signals in numerical form” and also conveys the quality of a "step-by-step" sequence[1].

The term “digital competence” refers to the knowledge and skills related to the use of digital devices in connection with specialized domain knowledge across various professional fields[2].

The use of electronic resources in the preschool education system leads to the following positive outcomes:

1. Multimedia presentations are presented in a symbolic form that is understandable for preschool-aged children, which helps them grasp the learning material more effectively and independently enhance their knowledge.
2. The attractiveness of computers and multimedia effects increases children's motivation to learn and boosts their interest in mathematics.
3. The knowledge acquired by children remains in their memory for a longer period, and it becomes easier for them to recall and apply it in practical situations.

Implementing computer-based education using multimedia in the educational and upbringing process of preschools (MTTs), developing and using multimedia educational tools as didactic resources, fostering computer literacy among learners, creating methodologies for multimedia-based computer education, and integrating them into the teaching and learning process of preschool institutions – all serve as a foundation for organizing educational activities based on innovative technologies. This process leads to the implementation of the planned modernization of the educational and upbringing system in preschool institutions.

When developing multimedia tools for preschool education institutions, the following criteria must be taken into consideration:

1. Taking into account the age of the learners.
2. Selecting didactic materials based on age-specific characteristics.
3. Studying pedagogical and psychological methods of influencing children during the educational process.

4. Ensuring a relaxation phase of about 15–20 minutes during sessions.

The main purpose of multimedia technologies is to create software products enriched with sound, video, animation, and other visual effects. Multimedia software products typically include an interactive interface and control mechanisms. Additionally, users of multimedia technologies have the opportunity to engage in design, create both static (non-moving) and dynamic (moving) visuals, and distribute the outcomes of their creative work to external environments through communication channels.

Multimedia consists of several components, each of which performs distinct functions and contributes to the overall formation of multimedia. These componentsinclude:text, audio, video, images, graphics, tables, animation, decorative elements. Digital technologies serve as an effective tool for enhancing education, implementing activity-based approaches, and enriching the learning environment in preschool educational institutions[3]. Through digital technologies, it is possible to develop basic mathematical skills in preschool-aged children[4]. The application of digital technologies also enables the implementation of distance learning, which not only helps to reduce unnecessary expenses, but also contributes to the formation of mature professionals who possess a modern worldview and knowledge, think independently, and will play a vital role in elevating the Republic of Uzbekistan to greater heights in the future[5].

Methods. This study employed a qualitative research design with elements of descriptive and exploratory methodology to investigate the role of digital technologies in enhancing the professional competencies of future teacher-educators, particularly within the context of preschool education. The research focused on identifying existing practices, tools, digital learning environments, and methodologies applied in pre-service teacher training programs.

The participants included:

- Pre-service teachers enrolled in early childhood education programs at pedagogical universities and colleges.
- In-service educators at preschool institutions for comparative analysis.
- Teacher educators and digital technology integration specialists involved in curriculum design and ICT-based instruction.

A total of 60 participants were selected using purposive sampling, ensuring diversity in teaching experience, digital fluency, and institutional settings (urban vs rural). Focus group discussions and semi-structured interviews were held with participants to gather insights.

The study utilized a multi-method approach for data collection:

- Semi-structured interviews with teacher-educators and trainees to explore their understanding, experience, and perception of using digital tools in pedagogical contexts.

- Observation protocols during classroom-based and virtual training sessions to assess the use of multimedia, digital platforms, and teaching strategies.

- Document analysis of curriculum materials, digital training modules, lesson plans, and e-resources used in preschool teacher preparation.

- Questionnaires containing both open- and closed-ended questions to evaluate digital competency levels and the frequency and effectiveness of tool usage.

In the experimental studies, students from higher education institutions such as Namangan State Pedagogical University (NSPU), Jizzakh State Pedagogical University (JSPU), and the Kokand Pedagogical Institute were selected to form the experimental and control groups. The experimental work conducted with these selected groups was carried out in two phases: an initial (diagnostic) phase and a final (formative) phase.

Results. Based on the results of the experimental study, we analyzed the effectiveness of the criteria for enhancing the heuristic competence of future preschool education institution teachers. The analysis was conducted using Student's mathematical-statistical method to compare the average academic achievement of the experimental and control groups.

At the beginning of the experiment, a total of 446 future preschool educators participated, and by the end, 442 participants remained. At the start of the experiment, the experimental group consisted of 224 individuals, and the control group included 222 individuals. By the end of the experiment, the experimental group had 222 participants, while the control group had 220 participants.

Indicators of the Effectiveness of Heuristic Competence Development Criteria Among Future Preschool Educators at the End of the Experiment

Criteria	Experimental Group (n = 222)			Control Group (n = 220)		
	High	Medium	Low	High	Medium	Low
Cognitive	64	62	96	35	42	143
Motivational	56	58	108	26	44	150
Creative	51	56	115	26	35	159
Personality-Oriented	80	78	64	51	55	114
Activity-Oriented	64	71	87	35	48	137

Discussion. The findings of the experimental study clearly demonstrate the effectiveness of integrating digital technologies in developing the heuristic competence of future preschool educators. The experimental group showed significantly higher results across all measured criteria–cognitive, motivational, creative, personality-oriented, and activity-oriented–compared to the control group. Notably, the proportion of participants in the high and medium levels of competence was markedly greater in the experimental group, while the control group had a higher concentration in the low-performance category. These outcomes indicate that digital tools, when applied systematically and purposefully within teacher training programs, foster deeper cognitive engagement, intrinsic motivation, creativity, and learner-centered professional growth. The implementation of multimedia-based methods appears to enhance active participation and self-directed learning, essential for early childhood education. Furthermore, the results validate the structured use of digital methodologies in pedagogical training as a catalyst for equipping future educators with 21st-century competencies.

Conclusion. The integration of digital technologies into the professional preparation of future preschool educators represents a transformative shift in the way teaching competencies are developed. This study has demonstrated that targeted use of multimedia tools, interactive platforms, and digital resources significantly enhances various dimensions of heuristic competence, including cognitive abilities, motivation, creativity, personal orientation, and activity-based skills.

The experimental findings affirm that learners exposed to a digitally enriched educational environment show improved levels of engagement, better retention of knowledge, and a stronger ability to apply concepts practically. Compared to the control group, the experimental group exhibited higher performance in all five measured competencies, particularly in the cognitive and personality-oriented domains. This suggests that digital technologies do more than supplement traditional instruction – they actively contribute to developing independent, reflective, and creative thinking among pre-service educators.

Moreover, the incorporation of digital tools supports the development of 21st-century skills such as digital literacy, problem-solving, and pedagogical adaptability. For preschool education, where visual, interactive, and learner-centered approaches are most effective, these technologies serve as both a medium and a catalyst for meaningful educational transformation.

The results emphasize the importance of revising teacher training curricula to include structured digital competencies, methodological innovation, and technology-supported evaluation systems. By fostering an environment of innovation and experimentation, higher education institutions can better prepare future educators to meet the demands of modern preschool education and lifelong learning.

This study contributes to the growing body of evidence that digital technologies are not only essential for improving professional training but also for nurturing a new generation of educators capable of shaping the future of early childhood education through informed, interactive, and adaptive teaching practices.

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