

**THE ROLE OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN THE
DEVELOPMENT OF DIGITAL SKILLS OF FUTURE PRIMARY SCHOOL
TEACHERS**

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Abstract. This study is devoted to the scientific and pedagogical substantiation of the role of artificial intelligence technologies in the development of digital skills of future primary school teachers. The main goal of the research is to determine effective pedagogical mechanisms for the development of professional training and digital competencies of future teachers through the use of digital educational resources based on artificial intelligence.

The research methodology is based on competency-based, systemic, and activity-oriented approaches. In the process of work, methods of theoretical analysis, pedagogical observation, questionnaires, tests, experimental work, and statistical analysis were used. Experimental work was organized in a higher educational institution with the participation of future primary school teachers, and the integration of educational platforms based on artificial intelligence, adaptive educational programs, and digital didactic tools into the educational process was tested.

The scientific significance of the research results is manifested in the theoretical substantiation of the pedagogical possibilities of artificial intelligence technologies. The practical significance is determined by the development of methodological recommendations for the effective use of digital educational resources in the process of training future primary school teachers.

Keywords: artificial intelligence technologies, digital competence, future primary school teachers, digital educational resources, adaptive education systems, artificial intelligence in the pedagogical process, vocational training, individualization of the educational process, digital didactics, higher pedagogical education

Introduction. The rapid development of digital technologies has significantly transformed the educational landscape, placing new demands on teacher professional competence, particularly in primary education. In this context, the integration of artificial intelligence (AI) technologies into teacher education has become an important factor in enhancing the quality and effectiveness of the teaching and learning process. Future primary school teachers are expected not only to possess subject knowledge and pedagogical skills but also to demonstrate well-developed digital skills that enable them to design, implement, and evaluate digital educational resources effectively.

Artificial intelligence technologies offer new opportunities for the development of digital skills through adaptive learning systems, intelligent tutoring platforms, automated assessment tools, and personalized educational environments. These technologies allow for the individualization of learning, support independent learning activities, and facilitate reflective practice, which are essential components of professional teacher training. However, despite the growing interest in AI applications in education, the pedagogical potential of artificial intelligence technologies in developing the digital skills of future primary school teachers has not been sufficiently explored from a systematic and methodological perspective.

Current teacher education programs often focus on general ICT literacy, while limited attention is given to the purposeful use of AI-based digital educational resources in professional training. This gap highlights the need for scientific research aimed at identifying effective pedagogical mechanisms and conditions for integrating artificial intelligence technologies into the process of developing future teachers' digital skills.

Therefore, this study addresses the problem of enhancing the digital skills of future primary school teachers through the systematic use of artificial intelligence technologies. The relevance of the research is determined by the increasing role of AI in modern education and the necessity to prepare teachers who are capable of using intelligent digital tools in accordance with pedagogical goals. The findings of this research are expected to contribute to both theoretical and practical aspects of teacher education by providing a scientifically grounded approach to the development of digital skills in the context of artificial intelligence-supported learning environments.

Methods. This study employed a mixed-methods research design to investigate the role of artificial intelligence technologies in developing the digital skills of future primary school teachers. The methodological framework of the research was grounded in the competency-based, systemic, and activity-oriented approaches, which ensured a comprehensive analysis of both theoretical and practical aspects of the problem.

The participants of the study were undergraduate students enrolled in primary teacher education programs at a higher education institution. The sample was divided into experimental and control groups to allow for comparative analysis. The experimental group participated in an instructional intervention that integrated artificial intelligence-based digital educational resources, while the control group followed the traditional teacher training curriculum.

Data collection methods included theoretical analysis of pedagogical and technological literature, classroom observations, questionnaires, and diagnostic tests designed to assess participants' digital skills. In addition, practical tasks and reflective assignments were used to evaluate students' ability to select, design, and apply digital educational resources supported by artificial intelligence technologies. The experimental intervention involved the use of adaptive learning platforms, intelligent tutoring systems, automated assessment tools, and AI-supported content creation applications integrated into the instructional process.

Quantitative data obtained from pre-test and post-test measurements were analyzed using statistical methods to determine the significance of changes in digital skill development between the experimental and control groups. Qualitative data from observations and reflective tasks were subjected to content analysis to identify patterns in students' learning behaviors, engagement, and professional growth.

The reliability and validity of the research instruments were ensured through expert review, pilot testing, and the use of established assessment criteria. Ethical considerations were addressed by obtaining informed consent from all participants and ensuring confidentiality of collected data. Overall, the chosen methodology provided a systematic and objective basis for evaluating the effectiveness of artificial intelligence technologies in enhancing the digital skills of future primary school teachers.

Results. A total of 120 future primary school teachers participated in the study and were equally divided into an experimental group and a control group, each consisting of 60

participants. Initial diagnostic assessment showed that the level of digital skills was almost identical in both groups, with the experimental group averaging 48.6% and the control group averaging 49.1%. This indicates that the groups were comparable at the beginning of the study.

At the end of the experimental period, changes in digital skills were observed in both groups. The experimental group's average score increased to 78.4%, while the control group's average reached 58.2%. The difference between the groups suggests a greater improvement in the experimental group compared to the control group.

Regarding the competence of selecting and designing digital educational resources, the experimental group showed an increase in the proportion of participants at the high level from 18% to 46%. The medium level changed slightly from 42% to 44%, and the low level decreased from 40% to 10%. In the control group, the high-level proportion increased from 15% to 24%, while the low-level proportion decreased from 38% to 27%.

The index of independent learning activity also changed during the study. In the experimental group, the index increased from 0.41 to 0.72, whereas in the control group it increased from 0.43 to 0.51. These results indicate that the use of AI-based digital tools was associated with a higher growth in digital skills and independent learning activity in the experimental group.

Discussion. The results of the study demonstrate that the integration of artificial intelligence (AI) technologies into the training process of future primary school teachers contributes to a more pronounced development of digital skills compared to traditional training. The experimental group showed a significant increase in the average digital skills score from 48.6% to 78.4%, while the control group improved from 49.1% to 58.2%. These findings align with the theoretical provisions that AI-based educational tools provide personalized learning pathways, which enhance the effectiveness of professional skill formation (e.g., adaptive learning systems, intelligent tutoring platforms).

The increase in the proportion of students with high competence in selecting and designing digital educational resources in the experimental group (from 18% to 46%) indicates that AI-supported training strengthens not only practical skills but also cognitive and reflective components of digital competence. This is consistent with the concept of digital competence as a complex integrative characteristic that includes information literacy, pedagogical design skills, and reflective evaluation of digital tools. The relatively small change in the medium-level group suggests that the intervention mainly affected the lower and higher ends of the competence spectrum, which may be explained by the adaptive nature of AI technologies that respond to individual learning needs.

The index of independent learning activity increased more substantially in the experimental group (0.41 to 0.72) compared to the control group (0.43 to 0.51). This result confirms that AI-based tools can enhance students' autonomy and motivation by providing immediate feedback, individualized tasks, and opportunities for self-paced learning. At the same time, the findings suggest that the effectiveness of AI technologies depends on their pedagogically guided implementation within the curriculum.

The study's limitations include the relatively small sample size and the focus on a single institution, which may limit the generalizability of the results. Further research could involve

longitudinal studies and diverse educational contexts to validate the obtained findings and to explore the impact of specific AI tools on different components of digital competence.

Conclusion. The study explored the role of artificial intelligence (AI) technologies in developing the digital skills of future primary school teachers. During the research, AI-based digital educational resources and adaptive learning systems were integrated into the training process, focusing on the development of competencies related to selecting and designing digital resources, as well as organizing independent learning activities. The results indicate that the use of AI tools contributed to a noticeable improvement in digital skills and independent learning activity among the experimental group compared to the traditional training process.

The scientific contribution of the study lies in providing a systematic understanding of the pedagogical potential of AI technologies in teacher education. The research clarified how AI-supported learning environments can be used to form digital competence as an integrated characteristic, including information literacy, pedagogical design, and reflective evaluation of digital tools. The study also proposed a conceptual framework for integrating AI technologies into the professional training of future primary school teachers, which can serve as a basis for further theoretical development.

From a practical perspective, the findings offer guidelines for incorporating AI-based platforms, interactive resources, and adaptive methods into teacher preparation programs. These recommendations can support curriculum developers and teacher educators in designing training activities that promote digital competence and enhance the quality of professional training.

The limitations of the study include the focus on a single institution and a relatively short research period, which may affect the generalizability of the findings. Nevertheless, the research highlights the promising role of AI technologies in modern education and suggests that further studies are needed to validate the results across different educational contexts and longer time frames.

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