

ENHANCING THE PROFESSIONAL AND METHODOLOGICAL TRAINING OF PROSPECTIVE PRIMARY SCHOOL TEACHERS THROUGH ARTIFICIAL INTELLIGENCE TECHNOLOGIES

Halimov Shahzod Zohidjon o'g'li

Namangan State Pedagogical Institute

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Abstract

The rapid integration of artificial intelligence (AI) into education is transforming the professional roles and methodological practices of teachers. For prospective primary school teachers, AI technologies can serve not only as digital tools but also as instruments for developing lesson-planning, assessment, differentiated instruction, reflective practice, and pedagogical decision-making skills. This thesis examines methodological approaches to strengthening the professional and methodological training of prospective primary school teachers through purposeful integration of AI technologies. Particular attention is given to the development of AI literacy, pedagogical AI competence, responsible use of generative AI, and the ability to critically evaluate AI-generated educational content. The study proposes a practice-oriented framework that combines theoretical preparation, guided experimentation, microteaching, reflective analysis, and project-based tasks. The approach is aimed at preparing future primary school teachers to use AI ethically, critically, and pedagogically effectively while maintaining the teacher's central role in educational decision-making.

Keywords: artificial intelligence, prospective primary school teachers, professional training, methodological training, AI competence, teacher education, generative AI, lesson planning, differentiated instruction, digital pedagogy.

Introduction

Artificial intelligence has become an increasingly significant component of contemporary educational environments. Generative AI systems, intelligent tutoring applications, automated feedback tools, adaptive learning technologies, and learning analytics can support teachers in designing instructional materials and responding to diverse learner needs. However, the availability of AI tools does not automatically lead to effective pedagogical use. Future teachers need a structured set of professional and methodological competencies that enables them to select appropriate tools, formulate effective prompts, verify outputs, protect learner data, recognize bias, and integrate AI into instruction without reducing learning to automated content generation. Primary education requires particular attention because young learners need age-appropriate explanations, carefully designed activities, emotional support, and strong teacher guidance. Consequently, the professional preparation of primary school teachers should combine traditional pedagogical foundations with new AI-related competencies. AI should be treated as a complementary instrument that enhances teachers' professional capacity rather than as a substitute for pedagogical judgment.

The purpose of the study is to substantiate methodological approaches for enhancing the professional and methodological training of prospective primary school teachers through the purposeful and responsible use of AI technologies. The main objectives are: to clarify the structure of AI-related professional competence in primary teacher education; to identify pedagogical conditions for integrating AI into methodological training; to develop practice-oriented learning activities based on AI tools; to strengthen prospective teachers' abilities in AI-assisted lesson planning, assessment and differentiation; and to establish criteria for evaluating the quality, ethics and pedagogical appropriateness of AI-supported activities.

The proposed approach is based on the integration of competency-based, activity-based, student-centered and reflective approaches. The competency-based approach focuses on the

ability to apply knowledge in authentic pedagogical situations. The activity-based approach emphasizes learning through practical tasks, microteaching and educational projects. The student-centered approach requires future teachers to use AI in ways that respond to learners' age, abilities, interests and learning difficulties. The reflective approach enables prospective teachers to analyze the strengths and limitations of AI-generated materials and justify their methodological choices. Within this framework, AI competence is understood as a multidimensional professional capacity consisting of technological awareness, pedagogical application, critical evaluation, ethical responsibility and reflective self-development. A future teacher should be able to understand what an AI system can and cannot do, select tools according to instructional objectives, produce and adapt learning materials, verify information, identify possible bias or inaccuracies, and ensure that the final educational decision remains under human professional control.

The proposed model can be organized into four interconnected stages. The first stage is orientation and AI literacy. Students become familiar with basic AI concepts, generative AI, prompt formulation, data privacy, intellectual property, academic integrity and responsible use. The second stage is guided methodological practice. Prospective teachers use AI to generate lesson ideas, adapt texts for different learner levels, prepare formative assessment questions and design interactive classroom activities under instructor supervision. The third stage is independent pedagogical design. Students develop complete lesson plans and teaching materials using AI as an assisting tool. They compare AI-generated suggestions with curriculum requirements, learning objectives and principles of primary education. They then revise the materials and provide methodological justification for each important decision. The fourth stage is reflection and evaluation. Students conduct microteaching, receive peer and instructor feedback, analyze the effectiveness of AI-supported materials and identify areas requiring improvement. This sequence is important because it moves learners from simple technological familiarity to professional pedagogical application. The central principle is not 'using AI as much as possible' but 'using AI when it improves a clearly defined learning objective.'

AI technologies can strengthen several components of prospective primary school teachers' preparation. In lesson planning, AI can assist in generating alternative activity ideas, differentiated tasks, examples and formative assessment questions. In instructional adaptation, AI can help simplify texts, create additional explanations and propose tasks for different levels of learner readiness. In assessment, AI can support the preparation of rubrics, question banks and feedback drafts, although teachers must verify the accuracy and appropriateness of all outputs. In reflective practice, AI can be used as a discussion partner for analyzing lesson plans, identifying potential weaknesses and generating alternative methodological solutions. Another important direction is the development of creative pedagogical materials. Future teachers can use AI to create story-based learning scenarios, problem situations, vocabulary exercises and interdisciplinary activities. Such applications can increase the variety of learning experiences, but the teacher must remain responsible for age appropriateness, cultural relevance, factual accuracy and alignment with curriculum outcomes.

Effective AI integration requires several pedagogical conditions. First, AI competence should be incorporated systematically into teacher education rather than taught as an isolated technological topic. Second, students should receive authentic methodological tasks that require them to solve educational problems with and without AI, allowing them to understand the added value and limitations of technology. Third, teacher educators should establish clear verification procedures for AI-generated content. Fourth, ethical principles, privacy, academic integrity, transparency and human oversight should be embedded into all practical activities. A further condition is the development of critical AI literacy. Prospective teachers should learn that AI-generated answers may contain factual errors, fabricated references, inappropriate generalizations or pedagogically weak recommendations. Therefore, every AI-supported product should pass through a verification cycle: checking factual accuracy, curriculum alignment, learner suitability, methodological coherence, language quality and ethical acceptability.

Implementation of the proposed model is expected to improve prospective teachers' ability to design learner-centered lessons, differentiate instruction, prepare formative assessment materials, critically evaluate digital information and reflect on their own pedagogical decisions. It may also contribute to increased confidence in working with emerging technologies and a stronger understanding of the relationship between technological tools and pedagogical objectives. The most important expected outcome is the formation of a balanced professional position in which the future teacher neither rejects AI nor relies on it uncritically. Instead, the teacher learns to determine when AI is useful, how it should be adapted, and when a professional decision must be made independently.

Conclusion

Artificial intelligence technologies create new opportunities for improving the professional and methodological preparation of prospective primary school teachers. Their educational value, however, depends primarily on the methodological competence of the teacher who uses them. The integration of AI into teacher education should therefore focus on developing a combination of technological, pedagogical, critical, ethical and reflective competencies. The proposed four-stage model—orientation and AI literacy, guided methodological practice, independent pedagogical design, and reflection and evaluation—provides a practical framework for embedding AI into prospective primary school teachers' professional preparation. Its key principle is the purposeful integration of AI into authentic pedagogical tasks while preserving human professional judgment. Further empirical research can focus on developing diagnostic tools for measuring prospective teachers' AI competence and testing the effectiveness of AI-enhanced methodological training in real educational settings.

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