PEDAGOGICAL FEATURES OF DEVELOPING FUTURE TEACHERS' PROFESSIONAL COMPETENCE THROUGH THE USE OF ARTIFICIAL INTELLIGENCE IN UZBEKISTAN

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Abstract: The rapid advancement of artificial intelligence (AI) technologies has introduced new opportunities for enhancing the professional competence of future teachers. In the modern educational paradigm, the integration of AI into pedagogical practice is not merely an auxiliary tool but a transformative factor that reshapes teaching methodologies, learning strategies, and assessment mechanisms. This article examines the pedagogical features of developing professional competence among prospective educators through the application of AI-based technologies. Special attention is devoted to the ways in which AI contributes to strengthening cognitive, methodological, and reflective skills, while simultaneously fostering adaptability to the rapidly changing demands of the digital age.

Keywords: Artificial intelligence; pedagogical features; professional competence; teacher education; digital pedagogy; future educators; educational innovation.

Introduction: The contemporary landscape of teacher education is increasingly defined by the pervasive integration of digital technologies and the transformative potential of artificial intelligence (AI), which collectively offer unprecedented opportunities for developing professional competencies among future educators. The twenty-first century educational paradigm no longer confines pedagogical activity to traditional classroom boundaries; rather, it is characterized by a dynamic interplay between human expertise and intelligent technological systems, enabling a more personalized, adaptive, and evidence-based approach to teacher preparation[1]. AI technologies, ranging from intelligent tutoring systems and adaptive learning platforms to data-driven assessment tools and virtual simulation environments, serve as catalysts for redefining the processes through which pedagogical knowledge, skills, and attitudes are cultivated. By systematically incorporating AI into teacher education programs, it becomes possible to scaffold the cognitive, metacognitive, and socio-emotional dimensions of future teachers' professional development, ensuring their readiness to navigate increasingly complex educational contexts[2]. Globally, the utilization of AI in teacher preparation has been acknowledged as a strategic priority by leading educational systems. In nations such as Finland, Singapore, and South Korea, AI-driven platforms are actively integrated into curriculum design, classroom management training, and formative assessment procedures, demonstrating tangible improvements in both learner engagement and instructor effectiveness. These international models highlight the capacity of AI technologies to facilitate differentiated instruction, enhance reflective teaching practices, and promote the development of critical problem-solving and decision-making skills[3]. The pedagogical significance of AI, however, extends beyond the mere automation of instructional tasks; it encompasses the cultivation of higher-order professional competencies, including analytical reasoning, adaptive planning, and the ability to critically evaluate instructional resources within technologically mediated learning environments. Consequently, AI functions as both a methodological instrument and an epistemic mediator, shaping the way future educators conceptualize, implement, and assess teaching and learning processes[4]. In the context of Uzbekistan, recent national reforms in teacher education

underscore the necessity of integrating AI-based methodologies to cultivate the professional competence of prospective teachers. Initiatives such as the "Digital Uzbekistan – 2030" program and the implementation of e-learning platforms within higher pedagogical institutions reflect a strategic emphasis on equipping educators with the skills necessary for operating within digitally enriched environments[5]. The inclusion of AI technologies in teacher training facilitates personalized learning trajectories, allows for the simulation of classroom management scenarios, and enables data-driven feedback mechanisms, thereby aligning national teacher preparation programs with international standards. At the same time, these developments raise pressing methodological and ethical considerations, including the need to ensure equitable access to technological resources, safeguard the privacy of student and teacher data, and provide comprehensive professional development to enable educators to effectively leverage AI in pedagogical practice. The theoretical foundation for AI-mediated teacher education is firmly rooted in constructivist, activity-oriented, and competency-based frameworks.

Literature review: The scholarly discourse on the integration of artificial intelligence into teacher education has been substantially informed by international research that interrogates both the transformative potential and the attendant challenges of technology-mediated pedagogical practices. Among the most influential contributions are the works of Neil Selwyn and Richard E. Mayer, whose investigations provide complementary insights into the theoretical, empirical, and practical dimensions of AI-based professional competence development. Selwyn, approaching the subject from a critical sociological perspective, emphasizes that while AI technologies present significant opportunities for enhancing teacher training, their adoption is inevitably shaped by broader socio-economic, political, and cultural forces. In his analyses, Selwyn asserts that technology cannot be regarded as a neutral instrument but is entwined with issues of equity, access, and power relations, and therefore the deployment of AI in educational contexts must be scrutinized for potential reproductions of existing inequalities. His research highlights the need for critical reflection on the ethical, organizational, and policy frameworks surrounding AI implementation, suggesting that the efficacy of technology-driven pedagogical innovations is contingent upon careful alignment with human-centered educational values[6]. In contrast, Mayer's work provides a cognitive and instructional lens through which AI-mediated learning can be examined. His research on multimedia learning and the principles of cognitive load theory underscores how intelligent systems can facilitate the acquisition of complex skills and knowledge by structuring information in a manner that aligns with learners' cognitive capacities. Mayer demonstrates that AI technologies, when appropriately designed, can support personalized learning pathways, provide immediate and adaptive feedback, and scaffold reflective practice, thereby contributing directly to the development of professional competencies among prospective teachers[7]. By integrating instructional design principles with AI capabilities, his findings suggest that technology can enhance both the efficiency and the depth of pedagogical training, supporting learners' engagement, metacognitive skill development, and problem-solving abilities. Taken together, the perspectives of Selwyn and Mayer illustrate the duality inherent in AI integration within teacher education: on one hand, the critical sociological lens cautions against unreflective adoption and emphasizes structural and ethical considerations; on the other hand, cognitive and instructional frameworks elucidate the mechanisms through which AI can concretely enhance professional competence. The synthesis of these approaches underscores that AI-based pedagogical strategies must be simultaneously technically sophisticated, theoretically grounded, and ethically informed, ensuring that technological tools serve as enablers of reflective, adaptive, and equitable teacher education rather than as autonomous or prescriptive solutions. The convergence of critical and cognitive perspectives

also highlights the importance of contextualized implementation: the effectiveness of AI in cultivating professional competencies is not universal but depends on the alignment of technological affordances with local educational infrastructures, cultural norms, and institutional practices[7]. In the specific context of developing future teachers' professional competence, the literature consistently identifies several key pedagogical features facilitated by AI. These include adaptive feedback mechanisms that guide reflective practice, virtual simulation environments for experiential learning, collaborative online communities for peer-to-peer mentoring, and data-driven diagnostic tools that inform individualized instruction. Selwyn's critique provides a cautionary lens, reminding stakeholders that such innovations must be critically interrogated to prevent the reinforcement of systemic inequities, while Mayer's empirical findings offer actionable strategies for leveraging AI to maximize learning outcomes and professional skill acquisition[8]. Consequently, contemporary scholarship converges on the principle that AI integration should be both deliberate and dynamic, fostering an environment in which prospective teachers can engage deeply with content, develop metacognitive awareness, and acquire the methodological, cognitive, and ethical competencies required for successful professional practice.

Methodology: The methodological framework of this study is grounded in a qualitative–quantitative integrative paradigm, which allows for a comprehensive exploration of how artificial intelligence-based tools contribute to the development of professional competence among prospective teachers. A descriptive-analytical approach was employed to examine theoretical foundations, while empirical evidence was integrated through interpretive synthesis of existing research findings and case studies from diverse educational contexts. The methodological stance of the study is informed by constructivist epistemology, which posits that knowledge is actively constructed through interaction with technological, social, and pedagogical environments, and therefore emphasizes the need to investigate not merely the technical affordances of AI but also its pedagogical and contextual embeddedness. In operational terms, the study utilized content analysis of scholarly literature to identify recurrent themes, conceptual frameworks, and pedagogical models that align AI technologies with competence development in teacher education. This analytical dimension was supported by comparative examination, whereby insights from different international contexts were juxtaposed to reveal convergences and divergences in AI adoption strategies. Furthermore, the study adopted elements of design-based research methodology, in which pedagogical scenarios involving AI tools—such as adaptive tutoring systems, intelligent feedback mechanisms, and virtual simulation environments—were theoretically modeled to assess their capacity to scaffold reflective practice, enhance metacognitive skills, and strengthen domain-specific pedagogical knowledge. Complementing these qualitative strategies, the study also drew upon principles of mixed-method evaluation, incorporating statistical inferences from secondary data to substantiate claims about the effectiveness of AI-driven approaches. The integration of quantitative indicators, such as student engagement rates, competence progression metrics, and learning outcome measurements reported in prior studies, provided empirical grounding for the interpretive analysis. Such triangulation ensures methodological rigor by combining the explanatory richness of qualitative insights with the evidential robustness of quantitative data. Overall, the methodological framework employed in this research can be characterized as multidimensional, reflexive, and iterative. By synthesizing content analysis, comparative examination, and design-based modeling within a mixed-method interpretive schema, the study demonstrates how artificial intelligence can be pedagogically harnessed to cultivate the professional competence of future teachers. This integrated methodology not only ensures analytical depth and empirical

validity but also reflects the complexity of contemporary educational systems, where technological, cognitive, and socio-ethical dimensions of teaching and learning are inextricably intertwined.

Results: The findings of this study indicate that the incorporation of artificial intelligence into teacher education significantly enhances the professional competence of prospective educators by promoting cognitive, methodological, and reflective capacities in a structured and adaptive manner. AI-mediated pedagogical interventions, including intelligent tutoring systems, adaptive learning platforms, and virtual simulation environments, were found to facilitate personalized learning trajectories, enabling students to engage deeply with content while receiving continuous, data-driven feedback tailored to their individual progress. This adaptive scaffolding not only strengthens domain-specific knowledge but also cultivates higher-order skills such as critical thinking, problem-solving, and reflective decision-making, which are essential for effective teaching practice. Moreover, the integration of AI tools fosters collaborative professional growth by providing platforms for peer-to-peer interaction, co-construction of instructional materials, and collective analysis of pedagogical scenarios. Prospective teachers demonstrate improved metacognitive awareness and the capacity to adjust instructional strategies in response to feedback generated by intelligent systems, suggesting that AI contributes to both self-regulated learning and professional self-efficacy. Comparative analysis of international case studies indicates that contexts with well-developed digital infrastructure and comprehensive teacher training programs achieve greater gains in competence development, whereas environments with limited technological access or insufficient professional preparation experience constraints in the effective utilization of AI tools. The results further highlight the dual role of AI as both an instructional enabler and a diagnostic instrument. By providing real-time analytics, adaptive assessments, and simulation-based problem-solving opportunities, AI facilitates continuous monitoring of learning progress, allowing for timely identification of strengths, weaknesses, and areas requiring intervention. This capability not only enhances the efficiency of professional competence development but also encourages reflective practice, iterative improvement, and evidence-based decision-making among future teachers. Additionally, the findings reveal that the pedagogical efficacy of AI is closely linked to the intentionality of its application. AI systems yield the most substantial improvements when integrated within coherent educational frameworks that align with constructivist, activity-oriented, and competency-based principles. Conversely, superficial or unstructured deployment of AI tools does not result in meaningful skill acquisition and may risk fostering dependency on technology rather than developing autonomous professional judgment. Overall, the study demonstrates that AI-mediated pedagogical practices constitute a transformative approach to teacher education, simultaneously enhancing knowledge acquisition, skill development, and reflective competence, while also presenting challenges that necessitate careful contextual adaptation, ethical consideration, and sustained professional development support.

Discussion: The integration of artificial intelligence into teacher education has generated robust scholarly debate, exemplified by the divergent perspectives of Neil Selwyn and Yong Zhao, whose analyses illuminate the opportunities and challenges inherent in AI-mediated pedagogical practices. Selwyn adopts a critical sociological stance, emphasizing that the adoption of AI in educational contexts must be scrutinized for potential reproduction of social inequalities, the commodification of learning, and the prioritization of efficiency over pedagogical depth. He contends that while AI can enhance procedural aspects of teacher training, its uncritical application risks reducing complex educational processes to algorithmically manageable tasks,

thereby undermining the humanistic and reflective dimensions essential for professional competence[9]. Selwyn's perspective underscores the necessity of embedding AI within broader ethical, institutional, and cultural frameworks to ensure equitable access, safeguard professional autonomy, and maintain the centrality of teacher judgment in decision-making processes. In contrast, Zhao presents an optimistic view, advocating that AI technologies have transformative potential to democratize knowledge, facilitate personalized learning, and foster creativity and adaptability among future teachers. His research highlights that intelligent systems can empower learners to engage in self-directed exploration, simulate complex classroom scenarios, and receive immediate feedback, thereby accelerating the development of reflective, analytical, and problem-solving competencies. Zhao argues that AI should be leveraged as a tool for innovation in pedagogy, enabling prospective educators to acquire not only technical proficiency but also the flexibility and ingenuity required to navigate increasingly complex educational environments[10]. The polemic between Selwyn and Zhao illuminates a central tension in contemporary discourse: the balance between cautionary critique and visionary optimism in AI integration. While Selwyn warns of the socio-ethical and institutional risks associated with technology-driven education, Zhao emphasizes its emancipatory and pedagogically enriching capacities. Reconciling these perspectives suggests that the effective development of professional competence through AI is contingent upon a deliberate, context-sensitive, and critically informed approach, in which technological innovation is aligned with humanistic educational goals and equity considerations.

Conclusion: In conclusion, the present study demonstrates that the strategic integration of artificial intelligence into teacher education serves as a powerful mechanism for fostering the professional competence of future educators, encompassing cognitive, methodological, and reflective dimensions. The findings underscore that AI technologies, including adaptive learning systems, intelligent feedback platforms, and virtual simulation environments, are not merely supplementary instructional tools but constitute transformative agents capable of reshaping pedagogical practices and enhancing professional skill acquisition.

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