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METHODOLOGICAL JOURNAL**<http://mentaljournal-jspu.uz/index.php/mesmj/index>**ARTIFICIAL INTELLIGENCE AND PEDAGOGICAL RESEARCH:
METHODOLOGICAL CHALLENGES IN DEVELOPING THE RESEARCH
ACTIVITIES OF PROSPECTIVE TEACHERS*****Ozoda Abdullayeva****Doctoral Student**Chirchik State Pedagogical University**e-mail: abdullayevaozoda1107@gmail.com**Chirchik, Uzbekistan*

ABOUT ARTICLE

Key words: artificial intelligence, pedagogical research, prospective teacher, research activities, research skills, methodological approach, critical thinking, reflection, academic integrity, digital competence.

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Abstract: This article analyzes the methodological changes emerging in the organization of prospective teachers' research activities as a result of the integration of artificial intelligence technologies into the pedagogical research process. The primary focus of the study is not on describing the technical capabilities of artificial intelligence, but rather on identifying the impact of these tools on prospective teachers' abilities to identify research problems, formulate research questions, search for and evaluate scholarly information, analyze evidence, draw independent conclusions, and reflectively evaluate their own research activities. The study integrates systemic, activity-based, competency-based, learner-centered, and reflective approaches as its methodological foundations. The perspectives of Uzbek researchers on artificial intelligence and pedagogical education were comparatively analyzed alongside international scholarly approaches. The findings substantiate the view that artificial intelligence should not be regarded as a distracting agent in prospective teachers' research activities, but rather as an intellectual tool that supports certain stages of scientific inquiry. The study proposes the sequence of "technological assistance – critical

Introduction. Today, the rapid development of artificial intelligence technologies is influencing not only the organizational and technological dimensions of the education system but also its epistemological foundations. Whereas students previously sought scholarly information primarily through libraries, research articles, monographs, electronic databases, and teachers’ recommendations, the widespread adoption of generative artificial intelligence has significantly expanded opportunities for information retrieval, preliminary systematization, question refinement, and the modeling of diverse perspectives. At the same time, these technologies are generating new challenges related to the reliability of scientific knowledge, authorship, academic integrity, human intellectual autonomy, and the evaluation of the authenticity of research findings. UNESCO emphasizes that the use of generative artificial intelligence in education and research should be grounded in a human-centered approach, that human intellectual autonomy must be preserved, and that information provided by AI should be critically evaluated [1;pp.7"–" 8].

This process is particularly significant from the perspective of developing prospective teachers’ research activities. A modern teacher must be developed not merely as a specialist who acquires existing pedagogical knowledge, but as an agent capable of identifying problems in their professional practice, substantiating them scientifically, analyzing evidence, and making pedagogical decisions based on research findings. Therefore, limiting the use of artificial intelligence to the framework of “accelerating the educational process” is insufficient. The central research problem lies in determining an appropriate balance between technological capabilities and individuals’ independent research activities.

This issue is becoming increasingly relevant in Uzbekistan’s higher education system as well. In particular, L. R. Zaripov’s study on the impact of artificial intelligence on the educational process in higher education highlights the potential of AI-based digital tools to individualize learning, support independent activity, and modernize the pedagogical process, while also emphasizing the need for their scientifically grounded application [4;pp.192"–" 199]. Extending this perspective to research activities, it can be concluded that the effectiveness of an AI tool is determined not by its mere availability, but by the methodological purpose toward which a research task is directed. In particular, when working with prospective teachers, using artificial

intelligence as a mechanism that provides ready-made answers may contradict the essence of research skills. For a researcher, the essential outcome is not the availability of an answer, but rather the acquisition of the process of understanding a problem, posing questions, seeking evidence, verifying evidence, and reaching conclusions. Therefore, this study examines the relationship between artificial intelligence and research activities not from a technologically deterministic perspective, but from a pedagogical and methodological standpoint.

Methods and research results. The methodological foundation of the study was formed through the integration of systemic, activity-based, competency-based, learner-centered, and reflective approaches. The systemic approach makes it possible to interpret research skills not as a collection of isolated operations, but as an interconnected system of motivational, cognitive, information-analytical, technological, reflective, and ethical components. The activity-based approach, in turn, assumes that these skills develop not merely through the provision of theoretical information, but through the completion of problem-based and research-oriented tasks. The competency-based approach links working with artificial intelligence not simply to technical proficiency, but to the ability to locate and evaluate scholarly information, use it responsibly, and make independent decisions.

This methodological position reveals the inherently dual nature of using artificial intelligence. On the one hand, AI enables the processing of large volumes of information within a short period, the grouping of ideas, assistance in formulating research questions, and the preparation of preliminary analytical materials. On the other hand, determining the scholarly value of an AI-generated response, verifying its source, evaluating the sufficiency of evidence, and formulating final conclusions require the researcher's intellectual engagement. UNESCO recommendations also emphasize that learners, teachers, and researchers should not accept information provided by AI as truth without examination, but should evaluate it critically [1; p. 37]. Thus, in the context of artificial intelligence, the focus of research activity is shifting from "finding" information to "determining its scholarly value." This transformation also requires a reconsideration of the content of research skills. While information retrieval was an important operation in traditional research activities, in the era of AI, selection, verification, cross-source comparison, and scholarly interpretation have assumed greater importance due to the abundance of information.

In a study published in 2026, Uzbek researcher A. Shakarov also analyzed the pedagogical and didactic potential of artificial intelligence tools in developing prospective teachers' research skills within higher pedagogical education. The author highlights the

capabilities of tools such as ChatGPT, Gemini, Scopus AI, Elicit, and Research Rabbit in conducting scholarly inquiry, analyzing information, and identifying problems [3; pp. 207–211]. Developing this perspective methodologically, it can be argued that the abundance of artificial intelligence tools does not, in itself, indicate the development of research skills. On the contrary, as the number of available tools increases, the demands placed on researchers' ability to select them, adapt them to specific tasks, and verify their results also intensify.

At the international level, the role of artificial intelligence in education is likewise being reconsidered on the basis of functional collaboration between humans and technology. UNESCO's AI competency framework for teachers identifies 15 competencies across the areas of human-centered mindset, AI ethics, AI foundations and applications, AI pedagogy, and professional learning [2; pp. 13–23]. The significance of this approach for prospective teachers' research activities lies in the fact that AI competency is not limited to the ability to perform technological operations. Instead, human responsibility, ethical decision-making, pedagogical appropriateness, and professional development are considered as an integrated system.

Based on this perspective, the research skills of prospective teachers involving the use of AI can be characterized through the following logical sequence: identifying a problem – formulating a research question – purposeful use of an AI tool – verifying the information obtained against sources – comparing alternative perspectives – analyzing scholarly evidence – drawing an independent conclusion – reflectively evaluating the research process. Within this sequence, AI functions not as the central subject of activity, but as a tool that supports certain operations. In this context, critical thinking emerges as a particularly important component of research activity. AI systems may provide information that appears fluent and logically coherent but is scientifically inaccurate or unverified. Therefore, for a student using an AI tool, the state of “receiving an answer” should not represent the conclusion of the research, but rather the beginning of a new stage of verification. This methodological position is consistent with the principles of scientific rigor, evidentiary support, and verification in pedagogical research.

A study by Uzbek researchers G. Arabova and M. Boltaboyeva, devoted to the integration of AI, critical thinking, and academic integrity in higher education, likewise notes that the use of artificial intelligence is accompanied by growing concerns regarding authorship, plagiarism, source reliability, and academic integrity [5; pp. 368–373]. From the perspective of developing research activities, this idea can be further elaborated by interpreting academic integrity not merely as a requirement to “avoid copying,” but as a culture of understanding the origin and

scholarly status of acquired information, verifying sources, and assuming intellectual responsibility for one's conclusions. From this perspective, prospective teachers' research skills in the process of using AI tools can develop through a three-stage model.

The first stage is technological assistance. At this stage, AI helps clarify a research problem, explain terminology, develop alternative questions, or systematize preliminary information. The second stage is critical verification. During this stage, students compare information provided by AI with scholarly sources, identify existing contradictions, and evaluate the reliability of evidence. The third stage is independent scholarly conclusion. Here, material provided by AI is used not as a ready-made result, but as supporting material for the researcher to formulate their own scholarly position.

This model can also serve as a methodological foundation for developing practical research assignments in the teaching of pedagogy. For example, simply asking a student to obtain an answer from an AI system regarding a particular pedagogical problem does not, in itself, develop research skills. Instead, students should first be required to identify the problem based on a pedagogical situation, put forward their initial hypothesis, then use AI to obtain alternative explanations, compare them with scholarly literature, and ultimately explain which conclusion is more strongly supported by evidence. Such an assignment integrates AI literacy with research activity.

Furthermore, correctly defining the functional boundaries between humans and AI is also an important methodological condition. UNESCO's AI competency framework emphasizes that teachers should prioritize human rights, human intellectual capacity, safety, and responsibility when using AI tools [2; pp. 16–20]. When applying this principle to prospective teachers' research activities, the question "What can AI do?" should be accompanied by the question "Which intellectual tasks should not be delegated to AI?"

Thus, from a methodological perspective, the purpose of developing research skills through AI tools is not to make students dependent on technology, but rather to teach them to use it consciously, critically, and responsibly. Within this approach, the relationship between technological tools and human thought is characterized not by competition, but by functional complementarity. AI may increase the speed of information processing; however, understanding the social and moral dimensions of a pedagogical problem, evaluating its educational consequences, and determining the human value of a particular pedagogical decision remain the responsibility of the researcher.

Discussion. The theoretical findings obtained indicate that the integration of artificial intelligence into pedagogical research should be examined not between two opposing positions—excessive idealization of technology and its complete rejection—but rather from a third, balanced methodological perspective. From the first position, AI is interpreted as a tool that almost entirely automates research activities. Within such an approach, students' independent thinking, source verification, and formulation of scholarly conclusions may become secondary tasks. From the second position, AI is regarded as a factor that poses a threat to scholarly activity, with restricting its use considered the primary solution. Neither position fully reflects the complexity of contemporary pedagogical reality.

In our view, an effective methodological position should be based on the concept of human–AI collaboration. Within this framework, artificial intelligence supports technical and certain analytical operations of research, while humans determine the purpose, content, ethical boundaries, and final scholarly interpretation of the problem. The studies of Holstein, McLaren, and Alevén also identify the organization of human and AI capabilities in a complementary manner when developing educational technologies as an important methodological direction (6;pp.27–52). When this approach is applied to prospective teachers' research activities, the structure of research assignments also changes. In a traditional assignment, students locate information, restate it, and draw a conclusion. In an AI-enhanced assignment, however, students express their initial perspectives, use AI to explore alternative positions, identify limitations in AI-generated responses, verify them against scholarly sources, and subsequently reconsider their initial views. Thus, the research assignment acquires a reflective-analytical rather than a reproductive character.

Such a transformation is also important for the professional preparation of prospective teachers. In school or higher education practice, teachers may use AI tools in various pedagogical situations; however, their professional responsibility does not end with simply accepting an answer provided by technology. They must adapt information to the pedagogical context, consider students' individual characteristics, evaluate the accuracy of the results, and, when necessary, be able to reject technological recommendations. In this sense, research skills become an important component of prospective teachers' professional autonomy in the era of AI.

Recent studies published in Uzbekistan also demonstrate that the relationship between AI and higher education is increasingly being connected with issues of digital competence, independent learning, academic integrity, and scholarly research. For example, in 2026,

Ulashov and Suyunova analyzed the use of AI and digital technologies in higher education in connection with the improvement of educational quality and scholarly research 7;pp.12"- " 15. This trend supports the argument advanced in the present article that AI integration should be evaluated not only in terms of educational outcomes, but also in terms of the development of research activities. On this basis, the following methodological logic should be prioritized in developing prospective teachers' research activities: using an AI tool → critically examining the results → verifying them against scholarly sources → comparing alternative positions → making an independent scholarly decision. This logic connects the technological component of research skills with their cognitive and reflective components.

Consequently, the actual value of artificial intelligence in pedagogical research is manifested not in its ability to make decisions on behalf of humans, but in its potential to enable researchers to devote more time to higher-level intellectual activities. However, this potential can produce positive outcomes only when students acquire the ability to engage in critical collaboration with technology. In this regard, the contemporary model of research skills development should integrate technological literacy with scientific and methodological literacy.

Conclusion. The research findings demonstrate that the integration of artificial intelligence into the pedagogical research process is qualitatively transforming the content of prospective teachers' research activities. The essence of this transformation lies not merely in the expansion of researchers' opportunities to work with information, but in the increasing demands placed on the processes of selecting, verifying, interpreting, and transforming scholarly information into independent scholarly conclusions.

For prospective teachers, the methodological purpose of using artificial intelligence should not be to obtain ready-made scholarly results, but rather to provide intellectual support for certain stages of the research process. In this regard, understanding the research problem, formulating the research question, making the final decision, and assuming responsibility for the scholarly conclusion should remain the responsibility of the human researcher.

The most important methodological conclusion substantiated in the study is that the sequence of "technological assistance – critical verification – independent scholarly conclusion" can be regarded as one of the key mechanisms for developing prospective teachers' research skills. This sequence makes it possible to integrate the use of AI tools with the intellectual autonomy of the researcher.

Furthermore, components such as critical thinking, reflection, academic integrity, verification of information reliability, and human responsibility are no less important than technological competence in the development of research activities. Therefore, when developing methodologies for using AI tools in the preparation of prospective teachers, it is advisable not to teach technological skills in isolation, but to integrate them with research methodology, scientific thinking, and professional reflection. Consequently, artificial intelligence tools can become not a factor that weakens prospective teachers' research activities, but rather a means of expanding their capabilities when appropriately organized from a methodological perspective. The essential condition for this is to position technology not as a substitute for human thought, but as a collaborative tool that enhances human scholarly and creative activity.

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