

PEDAGOGICAL CONDITIONS FOR DEVELOPING AI LITERACY IN PRE-SERVICE TEACHERS

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Abstract. The article addresses the problem of developing AI literacy among pre-service teachers in higher education. The relevance of the study is determined by the expanding use of artificial intelligence in educational settings and by the need to prepare future teachers for the meaningful, critical, and pedagogically appropriate use of AI tools in their professional practice. The purpose of the study was to theoretically substantiate and empirically test the pedagogical conditions for developing AI literacy of pre-service teachers at the university level. The study was designed as a quasi-experiment and conducted according to a pre-test/post-test scheme involving experimental and control groups. The participants were 120 students enrolled in teacher education programs at one of the universities in Almaty. The formative intervention was implemented during the first semester of the 2025–2026 academic year in the format of an elective course on AI tools with a workload of two hours per week. Data were collected using an author-designed questionnaire aimed at identifying the components of AI literacy and a practice-oriented task assessed by experts. The findings showed that positive changes across all analyzed indicators were more pronounced in the experimental group than in the control group. The most noticeable improvements were identified in the use of AI for solving pedagogical tasks, the quality of prompt formulation, and the selection and critical evaluation of generated content. It was concluded that the effectiveness of developing AI literacy among pre-service teachers is determined not only by access to AI tools but also by specially organized pedagogical conditions, including the integration of AI into professionally significant tasks, the development of a critical and reflective attitude toward generated outputs, and reliance on practice-oriented forms of learning. The practical significance of the study lies in the possibility of using its findings to update the content of teacher education.

Keywords: artificial intelligence, AI literacy, pre-service teachers, pedagogical conditions, higher education, quasi-experiment.

Introduction

The active introduction of artificial intelligence tools into educational practice in recent years has significantly changed the understanding of the content of professional training of a modern teacher. Previously, the digital readiness of a future teacher was mainly associated with the possession of electronic resources, platforms and online communication tools, but now the ability to meaningfully use AI tools in educational and professional activities, critically evaluate the results of their work, take into account the limitations of algorithms and correlate technological capabilities with pedagogical goals is becoming increasingly important [1, 2, 4]. In this regard, AI literacy is gradually taking an independent place in the structure of a teacher's professional competence and is beginning to be considered not as a private technical skill, but as a complex quality necessary for working in a digital educational environment [1, 5, 7].

Scientific interest in the problem of AI literacy in education has noticeably increased, but the content of this concept continues to be clarified. In a review study by D.T.K. Ng et al. AI literacy is considered as a multidimensional education that includes knowledge of the principles of functioning of artificial intelligence, skills of interaction with it, a critical attitude to its capabilities and limitations, as well as the ability to use AI in various contexts [1]. A similar trend can be traced in more recent works, which emphasize that AI literacy should be understood more broadly than just owning digital services, since it also includes assessing the reliability of generated content, understanding ethical risks, and responsible use of AI in educational practice [4, 7]. In turn, K. Sperling et al. It is shown that in studies on teacher education, interpretations of

AI literacy remain heterogeneous: some authors focus on the technical aspect, others on the didactic aspect, and others on the critical and ethical dimension [5]. This indicates that the problem requires further conceptual and applied specification in relation to the training of a future teacher.

An important area of modern research has become the consideration of AI literacy through the prism of a teacher's professional knowledge. Thus, I. Celik, developing the idea of Intelligent-TPACK, justifies the need to integrate knowledge about the capabilities of AI, pedagogical design and the ethical dimension of using intelligent tools in the educational process [2]. In a study by K.W. Yau et al. It is shown that teachers' ideas about teaching AI and its use in schools vary in depth and focus: from a predominantly instrumental understanding to a more holistic one related to methodological understanding and organization of learning [3]. A significant contribution to the development of this issue was made by the work of T.K.F. Chiu, Z. Ahmad and M. Çoban, which presents a scale of self-efficacy of AI-teacher competence, including such dimensions as AI knowledge, AI pedagogy, assessment, ethics, human-centered education and professional engagement [10]. These studies show that the AI literacy of a future teacher cannot be reduced to the possession of individual services, but should be understood as a multicomponent professional characteristic [2, 3–10]. At the same time, there is increasing attention in the literature to the training of future teachers. A study by M.A. Ayanwale et al. It has shown that the level of AI literacy of students of pedagogical programs is directly related to their willingness to work in future classes, where AI will become part of the educational reality [6]. I. Runge, F. Hebibi and R. Lazarides found that taking specialized courses related to AI is positively associated with the perception of the usefulness of AI and the formation of an AI-TPACK among future teachers [11]. L. Guan et al. Attention is drawn to the fact that students' readiness for AI-integrated learning includes not only technology application skills, but also a change in pedagogical position, professional identity and ideas about the role of a teacher [12]. Similar conclusions are found in the work of L. Kohnke et al., which emphasizes the need for special training of future teachers to work in AI-enhanced classrooms, as well as developing not only technological confidence, but also the ability to integrate AI into the educational process in a meaningful and pedagogically justified way [13]. Thus, international studies quite convincingly show that the AI literacy of future teachers requires targeted education within the framework of professional training [6, 11–13].

At the same time, modern publications emphasize that effective training in this field cannot be reduced to familiarizing students with a list of digital services. Y. Lan shows that the inclusion of AI in the pedagogical education system affects a deeper level – the level of professional identity, pedagogical motivation and attitude to the future profession [8]. X. Tan, G. Cheng and M.H. In a systematic review, Ling notes that the field of AI research in teaching and professional development of teachers is actively expanding, but there are still not enough works in it that offer empirically proven training models and describe specific pedagogical conditions for the formation of appropriate competencies [9]. B. Pei et al. It is emphasized that the development of AI literacy among future teachers requires practice-oriented learning, the inclusion of professionally significant tasks and conditions in which the student does not just use AI, but analyzes its capabilities, limitations and pedagogical relevance [14]. In this logic, the question of not only whether AI should be included in pedagogical training becomes particularly important, but also under what pedagogical conditions such inclusion really leads to the development of AI literacy.

This problem has additional relevance for Kazakh teacher education. Recent Russian studies have also emphasized the importance of digital training of future teachers, their adaptation to new educational technologies and the formation of professionally oriented competence in the digital environment. In particular, Z.S. Yesmakhanova, S.V. Sumatokhin and G.T. Zhussipova consider digital technologies as an important resource for the formation of professional competencies of future teachers [14]. M. Kurmasheva, A. Zhorabekova and M. Duisenova associates the professionally oriented competence of a future teacher with the conditions of digital adaptive learning [15]. Zh.E. Esenalieva, L. Kazyhankyzy and Zh.K. Makhanova show that future teachers generally positively perceive digital innovative tools, but their use requires methodically structured support and

meaningful inclusion in the educational process [16]. At the same time, it should be noted that domestic publications are more often focused on the issues of digital competence in a broad sense, while research specifically aimed at developing AI literacy of future teachers within the framework of an empirically verifiable model of university education is still insufficiently represented [14–16].

Thus, the analysis of the literature makes it possible to identify a contradiction between the increasing importance of AI literacy as a component of the professional training of a future teacher and the insufficient development of pedagogical conditions for its purposeful formation at a university, especially in empirical studies based on the training of students in pedagogical fields. In other words, the scientific literature has already convincingly shown the importance of AI literacy for future teachers. [1, 4, 6, 7], The individual components of the relevant competence are described [2, 10], as well as the role of special training courses and practice-oriented forms of training [11, 13], however, the question of which pedagogical conditions in the university environment ensure a more pronounced formation of AI literacy among future teachers remains not fully disclosed [8, 9, 14].

In this regard, the *purpose* of the study is to theoretically substantiate and empirically verify the pedagogical conditions for the formation of AI literacy of future teachers at the university.

The research question is formulated as follows: *what pedagogical conditions for the organization of a special elective course contribute to a more effective formation of AI literacy among students of pedagogical educational programs?*

The *hypothesis* of the study is that the inclusion in the educational process of future teachers of a specially organized elective course based on practical work with AI tools, critical assessment of their results and solving professionally significant pedagogical tasks, will contribute to a more pronounced increase in AI literacy indicators compared with standard training without such a course [9, 11–14].

Methods and materials

The study was organized as a quasi-experimental one and was conducted according to the pre-test/post-test scheme with the participation of experimental and control groups formed on the basis of existing academic groups. This design was chosen due to the impossibility of a random distribution of students in the conditions of the real educational process at the university. The research was based on one of the universities of Almaty, presented in the article in an impersonal format.

120 students of pedagogical training fields participated in the study, 63 of them studied under the educational program “Pedagogy and methods of primary education,” and 57 under the program “Preschool education.” The gender structure of the sample was dominated by women (about 91%), the proportion of men was about 9%. The experimental group consisted of 58 students, the control group – 62. In the field of “Pedagogy and methods of primary education,” the experimental group consisted of 30 students, the control group – 33; in the field of “Preschool education” – 28 and 29 students, respectively. The experiment was conducted during the first semester of the 2025–2026 academic year – from September 5 to December 25, 2025. An elective course on AI tools of 2 hours per week was implemented in the experimental groups. Its content was focused on the formation of AI literacy for future teachers and included the development of generative AI services, the compilation of effective queries, critical evaluation of generated content, the identification of AI errors and limitations, as well as the use of AI in the development of educational materials, assignments and lesson elements. In the control groups, the training was carried out within the framework of a standard educational program without a special elective course. The formative impact materials included four interrelated content blocks: an introduction to the educational opportunities and limitations of generative AI; techniques for making queries and analyzing the quality of responses; the use of AI in the development of educational materials, assignments, assessment criteria and lesson fragments; ethical and academic aspects of working with AI in teaching. The practical part of the course was based on mini-cases, tasks for finalizing AI responses, comparing original and revised versions of materials, as well as a reflective discussion of typical errors, limitations and risks of using AI in education.

Two complementary tools were used to collect the data. The first was an author's questionnaire aimed at identifying the level of AI literacy of students in the following components: understanding the capabilities and limitations of AI, critical and ethical assessment of AI responses, the use of AI in solving pedagogical tasks and the use of AI for professional self-development. The author's questionnaire included 16 statements combined into four scales of 4 points each; the answers were recorded on a five-point Likert scale from 1 to 5 points. The integral indicator was calculated as the average value on all scales. The second tool was a practice-oriented task, in which students developed a piece of educational material using AI and justified the expediency, correctness and pedagogical relevance of the result. The practice-oriented task was evaluated according to five criteria: the relevance of using AI, the quality of the formulated query, the critical assessment of the generated content, the pedagogical expediency of the result, and compliance with ethical and academic standards. Each criterion was evaluated on a scale from 0 to 3 points; the maximum final score was 15. This allowed us to assess not only self-esteem, but also the demonstrated level of AI literacy.

The study included three stages: ascertaining, forming and control. At the first stage, entrance diagnostics was performed in the experimental and control groups. At the second stage, an elective course was implemented in the experimental groups. At the third stage, the final diagnosis was carried out, followed by a comparison of the results.

The data was processed using descriptive statistics methods, the Student's t-test for independent samples, the paired t-test for assessing intragroup dynamics, and ANCOVA for analyzing final intergroup differences with control of pre-test values. To assess the internal consistency of the author's questionnaire, the Cronbach's alpha coefficient was calculated, and the ICC coefficient was used to determine the consistency of expert assessments on a practice-oriented task. The differences at $p < 0.05$ were considered statistically significant. The study was conducted in compliance with the principles of voluntary participation, confidentiality and anonymization of data.

Results and discussion

The author's AI literacy questionnaire showed acceptable internal consistency: $\alpha = 0.88$ for the integral indicator; on separate scales, the values ranged from 0.74 to 0.81. The practice-oriented task was evaluated by two experts; inter-expert consistency was at a good level ($ICC = 0.81$). This allows us to consider the diagnostic package used as reliable enough to compare groups at the initial and final stages of the study.

At the ascertaining stage, there were no statistically significant differences between the experimental and control groups in terms of the main indicators, which allows us to consider the groups as generally comparable before the beginning of the formative impact.

Table 1 – Baseline comparability of the experimental and control groups (before the start of the experiment)

Indicator	EG (n = 58), M ± SD	CG (n = 62), M ± SD	p
Understanding of AI capabilities and limitations	2.78 ± 0.60	2.84 ± 0.58	0.571
Critical and ethical evaluation of AI-generated responses	2.61 ± 0.63	2.67 ± 0.61	0.603
Use of AI in solving pedagogical tasks	2.73 ± 0.58	2.79 ± 0.56	0.548
Use of AI for professional self-development	2.69 ± 0.62	2.74 ± 0.60	0.661
Integral indicator of AI literacy	2.70 ± 0.52	2.76 ± 0.49	0.486
Practice-oriented task (0–15 points)	5.9 ± 2.1	6.1 ± 2.0	0.628

As can be seen from Table 1, at the entrance stage, the differences between the groups were minimal and statistically insignificant. This creates a reason to associate subsequent changes not with the initial advantage of one of the groups, but with the peculiarities of the organization of the educational process in the experimental condition.

At the control stage, positive dynamics was recorded in both groups, but its severity was markedly different. In the experimental group, growth was observed in all components of AI literacy and was more pronounced than in the control group. There were also some positive changes in the control group, which may be due to the general background of digitalization of the educational environment, students' independent access to AI services and the natural accumulation of learning experience during the semester.

Table 2 – Dynamics of AI literacy indicators in experimental and control groups

Indicator	EG before, M ± SD	EG after, M ± SD	Δ	p	CG before, M ± SD	CG after, M ± SD	Δ	p
Understanding of AI capabilities and limitations	2.78 ± 0.60	3.70 ± 0.54	+0.92	<0.001	2.84 ± 0.58	3.00 ± 0.60	+0.16	0.031
Critical and ethical evaluation of AI-generated responses	2.61 ± 0.63	3.56 ± 0.57	+0.95	<0.001	2.67 ± 0.61	2.83 ± 0.63	+0.16	0.064
Use of AI in solving pedagogical tasks	2.73 ± 0.58	3.79 ± 0.51	+1.06	<0.001	2.79 ± 0.56	3.04 ± 0.57	+0.25	0.012
Use of AI for professional self-development	2.69 ± 0.62	3.49 ± 0.59	+0.80	<0.001	2.74 ± 0.60	2.90 ± 0.62	+0.16	0.083
Integral indicator of AI literacy	2.70 ± 0.52	3.63 ± 0.46	+0.93	<0.001	2.76 ± 0.49	2.94 ± 0.51	+0.18	0.049
Practice-oriented task (0–15 points)	5.9 ± 2.1	10.7 ± 2.4	+4.8	<0.001	6.1 ± 2.0	7.9 ± 2.3	+1.8	0.041

Note: EG = experimental group; CG = control group; Δ = mean change from pre-test to post-test. The *p* values refer to within-group changes assessed using paired-samples t-tests.

As can be seen from Table 2, the most pronounced increase in the experimental group occurred in the component related to the use of AI in solving pedagogical tasks (Δ = +1.06), followed by the critical and ethical evaluation of AI-generated responses (Δ = +0.95). The dynamics in the component of using AI for professional self-development turned out to be somewhat less intense, although also distinct (Δ = +0.80). This may indicate that students learn the applied pedagogical use of AI faster than deeper reflection on its role in their own professional development.

In the control group, the most noticeable shift was recorded on the scale of the use of AI in solving pedagogical tasks (Δ = +0.25), while the changes in the critical, ethical and reflexive components were weak and did not reach stable statistical significance. This picture seems quite

natural: without a specially organized course, students tend to master primarily the utilitarian functions of digital tools, while critical and pedagogically meaningful work with them is slower to form.

To clarify the impact of the formative impact, an analysis of the final indicators was performed with the control of the initial level and the educational program.

Table 3 – Between-group differences at the post-test stage (ANCOVA controlling for pre-test scores)

Indicator	Adjusted mean, EG	Adjusted mean, CG	F	p	η^2
Understanding of AI capabilities and limitations	3.68	3.02	17.24	< 0.001	0.128
Critical and ethical evaluation of AI-generated responses	3.54	2.85	13.67	< 0.001	0.105
Use of AI in solving pedagogical tasks	3.77	3.06	20.91	< 0.001	0.154
Use of AI for professional self-development	3.47	2.92	8.74	0.004	0.070
Integral indicator of AI literacy	3.62	2.96	24.48	< 0.001	0.173
Practice-oriented task (0–15 points)	10.6	8.0	19.32	< 0.001	0.144

Note: Adjusted means were estimated using ANCOVA, with the corresponding pre-test score and educational programme included as covariates. EG = experimental group; CG = control group; η^2 = partial eta squared.

The ANCOVA results (Table 3) show that after controlling the baseline level, the differences between the groups persist and remain statistically significant across all analyzed indicators. The most pronounced effect was found for the integral indicator of AI literacy ($\eta^2 = 0.173$) and for the component related to the use of AI in solving pedagogical tasks ($\eta^2 = 0.154$). This suggests that the elective course had the strongest impact precisely on the aspect of AI literacy associated with the applied integration of AI into the professional actions of future teachers. The influence of the educational program as a separate factor was weak and did not reach statistical significance for the integral indicator ($F = 1.84$; $p = 0.177$). The differences between the experimental and control groups at the post-test stage are clearly illustrated in Figure 1. As can be seen, after controlling for pre-test scores, the adjusted mean values in the experimental group were higher across all analyzed parameters. The most noticeable differences were observed for the integral indicator of AI literacy, the pedagogical use of AI, and the critical and ethical evaluation of AI-generated responses.

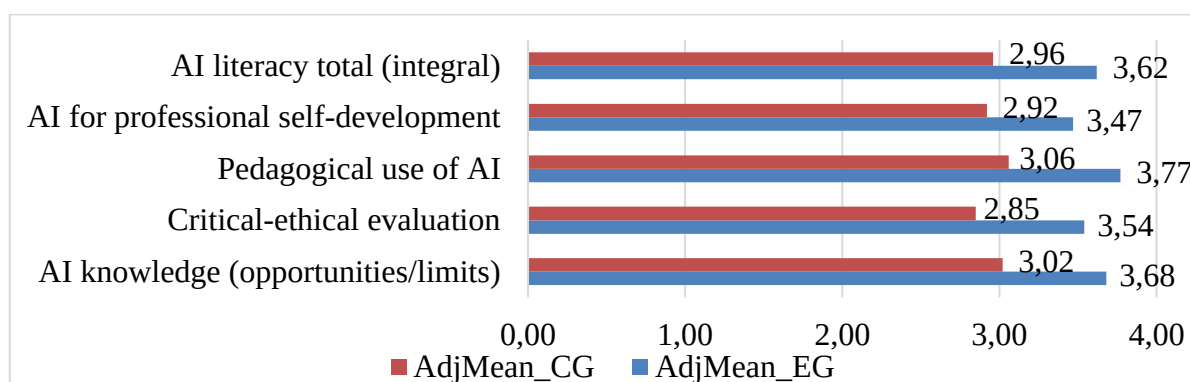


Figure 1 – Adjusted mean scores of AI literacy in the EG and CG at the post-test stage

To avoid relying solely on self-report data, the results of the practice-oriented task were additionally analyzed by separate criteria.

Table 4 – Results of the practice-oriented task at the post-test stage

Criterion	EG (n = 58), M ± SD	CG (n = 62), M ± SD	p
Appropriateness of AI use	2.26 ± 0.56	1.68 ± 0.63	< 0.001
Quality of the formulated prompt	2.08 ± 0.67	1.49 ± 0.71	< 0.001
Critical evaluation of generated content	1.94 ± 0.72	1.37 ± 0.69	< 0.001
Pedagogical appropriateness of the result	2.21 ± 0.59	1.58 ± 0.66	< 0.001
Compliance with ethical and academic standards	2.19 ± 0.61	1.81 ± 0.65	0.004
Total score (0–15)	10.68 ± 2.41	7.93 ± 2.33	< 0.001

As follows from Table 4, the greatest differences between the groups were found according to criteria related to the relevance of the AI application, the quality of the query and the pedagogical expediency of the result. The difference in the criteria of compliance with ethical and academic standards turned out to be somewhat less pronounced, although also statistically significant. This indirectly indicates that even with a special course, the ethical and reflective dimension of AI literacy is more difficult to form and requires longer and more systematic work.

The results obtained allow us to draw several meaningful conclusions. First of all, it is noteworthy that the formation of AI literacy in a university setting turned out to be more effective where working with AI was integrated into solving professionally significant pedagogical tasks, and was not limited to familiarization with individual digital services. The most noticeable growth in the experimental group was observed on the scale of the use of AI in solving pedagogical tasks, which is in good agreement with the conclusions of research, which emphasizes the need to link AI literacy not only with technological awareness, but also with pedagogical action, professional choice and the context of application [2, 10, 11].

The second important point is related to the fact that the differences between the groups were manifested not only in the questionnaire indicators, but also in the results of the practical task. This is of fundamental importance, since one of the frequent problems of research on digital and AI competence is an excessive reliance on self-reporting. In the presented model, the students of the experimental group coped better with the formulation of queries, selected the generated content more meaningfully, and more often demonstrated the pedagogically justified use of AI. This picture generally corresponds to the positions of those authors who believe that AI literacy should be assessed not only through knowledge and attitudes, but also through real ways of acting in professionally significant situations [1, 5, 7].

Special attention should be paid to the difference in the severity of dynamics for individual components. Although positive changes were recorded on all scales in the experimental group, the weakest increase was observed in the component associated with the use of AI for professional self-development. In addition, in the practical task, it was the ethical and academic criterion that turned out to be less contrasting than others. It looks quite natural. Mastering the applied functions of AI – for example, creating educational materials, generating assignments, designing explanations – usually happens faster, because students immediately see the instrumental benefits of technology. On the contrary, a critical understanding of the limitations of AI, the formation of stable ethical guidelines and the inclusion of AI in the broader context of professional self-development require more prolonged reflective work [4, 8, 9].

In this sense, the results of the study confirm the conclusions of international studies, according to which the AI literacy of a future teacher is multicomponent and does not come down to the technical confidence of the user [1, 5]. It includes, at least, knowledge of the capabilities of

AI, an understanding of its limitations, the ability to use the tool pedagogically appropriately, as well as the willingness to critically evaluate the results of its work and correlate them with professional standards [2, 7, 10]. That is why the heterogeneity of growth in different components found in the experimental group enhances the plausibility of the results rather than weakens it: the development of such skills does occur unevenly.

It should also be noted that the slight positive trend in the control group does not look unexpected. In today's digital environment, even without a special elective, students often turn to generative services on their own, use them in their daily learning activities, and gradually master some of the functions at the utilitarian level. However, without specially organized pedagogical work, such changes, as a rule, remain fragmented. This, apparently, can explain the fact that in the control group there were moderate shifts in knowledge and applied use of AI, but significantly less pronounced results in critical and ethical assessment and professional self-development. This trend is consistent with the findings of studies that show that the simple availability of AI tools alone does not ensure the formation of mature AI literacy among future teachers [6, 12, 13].

The results obtained are of particular interest for the Kazakh context. Domestic publications in recent years have already quite confidently recorded the importance of digital training of future teachers, the development of their professionally oriented competence and adaptation to the use of modern technologies [14–16]. However, there are still relatively few empirical studies focusing on AI literacy as an independent object of pedagogical education. In this regard, the proposed elective course model can be considered as one of the possible practical responses to the request of the higher pedagogical school, which is striving to move from general digital training to a more substantive and methodically structured development of AI tools. However, the presented results should not be interpreted as evidence of the complete or complete formation of AI literacy among the students of the experimental group. Even at the final stage, the average values on a number of scales did not reach the maximum levels, and the critical and ethical assessment component retained a well-known “growth zone”. This allows us to draw an important methodological conclusion: one semester course is enough to start a positive trend, but not enough to comprehensively develop all aspects of AI literacy. More sustainable changes probably require end-to-end integration of work with AI into the system of pedagogical training, including methodological disciplines, pedagogical practice and reflexive forms of support.

The study has a number of limitations that should be considered when interpreting the results. Firstly, the work was carried out on the basis of a single university, which limits the possibility of a broad generalization of conclusions. Secondly, the quasi-experimental design using ready-made academic groups did not ensure a random distribution of participants. Thirdly, the duration of the formative impact was limited to one semester, so the changes reflect the initial stage of AI literacy formation rather than its fully completed level. Finally, some of the data was obtained on the basis of students' self-assessment, which may increase the risk of subjective bias, despite the inclusion of practice-oriented assignments and peer review.

Thus, the discussion of the results allows us to assert that the effectiveness of the formation of AI literacy of future teachers is determined not by the very fact of applying to AI, but by the quality of the pedagogical organization of this process. Three interrelated conditions turned out to be the most productive within the framework of this model: the inclusion of AI in solving professionally significant pedagogical tasks, a systematic critical assessment of the generated content, and reliance on practice-oriented tasks that require pedagogical processing rather than copying the result. It was this logic, apparently, that provided a more noticeable dynamics of indicators in the experimental group.

Conclusion

The conducted research has shown that the formation of AI literacy of future teachers at the university is a pedagogically significant and practically solvable task. The results demonstrated that a specially organized elective course focused on working with AI tools, solving professionally significant pedagogical tasks, critically evaluating generated content and understanding the ethical

aspects of using artificial intelligence contributes to a more pronounced positive dynamic compared to standard training. The most noticeable changes were recorded in those components related to the applied use of AI in pedagogical activity, the quality of query formulation and the pedagogical expediency of the results obtained. At the same time, the less pronounced dynamics in terms of critical, ethical and reflexive components shows that the formation of AI literacy requires not a one-time acquaintance with digital services, but longer and systematic work in the structure of the future teacher's professional training. The practical significance of the research lies in the fact that the proposed pedagogical conditions and the logic of the elective course can be used to update the content of students' training in pedagogical educational programs. The results obtained allow us to consider AI literacy as an important component of the professional competence of a modern teacher and as a promising area for further empirical research in the field of teacher education.

Author Contributions:

Zholdybekova A. – conceptualization, methodology, investigation, and writing of the original draft.

Rakhimgaliyeva P. – methodology, formal analysis, validation, and review and editing of the manuscript.

Oryngaliyeva Sh. – investigation, data curation, visualization, and review and editing of the manuscript.

Dakina G. – investigation, resources, project administration, and review and editing of the manuscript.

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БОЛАШАҚ МҰҒАЛІМДЕРДІҢ ЖИ САУАТТЫЛЫҒЫН ДАМУДЫҢ ПЕДАГОГИКАЛЫҚ ШАРТТАРЫ

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Аңдатпа. Мақалада жоғары білім беру жағдайында болашақ педагогтардың AI-сауаттылығын қалыптастыру мәселесі қарастырылады. Зерттеудің өзектілігі білім беру ортасында жасанды интеллектті қолдану тәжірибесінің кеңеюімен және болашақ мұғалімді AI-құралдарын кәсіби қызметінде саналы, сыни және педагогикалық тұрғыдан мақсатқа сай қолдануға даярлау қажеттілігімен айқындалады. Зерттеудің мақсаты жоғары оқу орнында болашақ педагогтардың AI-сауаттылығын қалыптастырудың педагогикалық шарттарын теориялық тұрғыдан негіздеу және эмпирикалық тұрғыдан тексеру болды. Зерттеу квазиэксперимент ретінде ұйымдастырылып, эксперименттік және бақылау топтарының қатысуымен pre-test/post-test сызбасы бойынша жүргізілді. Зерттеуге Алматы қаласындағы жоғары оқу орындарының бірінің педагогикалық білім беру бағдарламаларында оқитын 120 студент қатысты. Қалыптастырушы ықпал 2025–2026 оқу жылының бірінші семестрі бойы аптасына 2 сағат көлеміндегі AI-құралдары бойынша элективті курс форматында жүзеге асырылды. Деректерді жинау үшін AI-сауаттылық компоненттерін анықтауға бағытталған авторлық сауалнама және сараптамалық бағалаумен толықтырылған практикалық-бағдарлы тапсырма пайдаланылды. Нәтижелер эксперименттік топта барлық талданған көрсеткіштер бойынша оң динамиканың бақылау тобына қарағанда айқынырақ болғанын көрсетті. Ең елеулі өзгерістер AI-ды педагогикалық міндеттерді шешуде қолдану, сұраныстарды тұжырымдау сапасы, генерацияланған контентті іріктеу және сыни бағалау салаларында анықталды. Болашақ педагогтардың AI-сауаттылығын қалыптастырудың тиімділігі тек AI-құралдарының қолжетімділігімен ғана емес, сонымен қатар арнайы ұйымдастырылған педагогикалық шарттармен де анықталатыны жөнінде қорытынды жасалды. Оларға AI-ды кәсіби мәні бар міндеттерді шешуге енгізу, генерация нәтижелеріне сыни-рефлексиялық қатынасты дамыту және практикалық-бағдарлы жұмыс түрлеріне сүйену жатады. Зерттеудің практикалық маңыздылығы оның нәтижелерін педагогикалық білім беру мазмұнын жаңартуда қолдану мүмкіндігімен байланысты.

Кілт сөздер: жасанды интеллект, AI-сауаттылық, болашақ педагогтар, педагогикалық шарттар, жоғары білім, квазиэксперимент.

ПЕДАГОГИЧЕСКИЕ УСЛОВИЯ РАЗВИТИЯ ИИ-ГРАМОТНОСТИ У БУДУЩИХ УЧИТЕЛЕЙ

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Аннотация. В статье рассматривается проблема формирования ИИ-грамотности будущих педагогов в условиях высшего образования. Актуальность исследования обусловлена расширением практик использования искусственного интеллекта в образовательной среде и необходимостью подготовки будущего учителя к осмысленному, критическому и педагогически целесообразному применению ИИ-инструментов в профессиональной деятельности. Цель исследования состояла в теоретическом обосновании и эмпирической проверке педагогических условий формирования ИИ-грамотности будущих педагогов в вузе. Исследование было организовано как квазиэкспериментальное и проведено по схеме pre-test/post-test с участием экспериментальной и контрольной групп. В исследовании приняли участие 120 студентов педагогических образовательных программ одного из университетов г. Алматы. Формирующее воздействие осуществлялось в течение первого семестра 2025–2026 учебного года в формате элективного курса по ИИ-инструментам объемом 2 часа в неделю. Для сбора

данных использовались авторский опросник, направленный на выявление компонентов AI-грамотности, и практико-ориентированное задание с экспертным оцениванием. Результаты показали, что в экспериментальной группе положительная динамика по всем анализируемым показателям была более выраженной, чем в контрольной. Наиболее заметные изменения были выявлены в области использования AI для решения педагогических задач, качества формулирования запросов, отбора и критической оценки сгенерированного контента. Сделан вывод о том, что эффективность формирования AI-грамотности будущих педагогов определяется не только доступностью AI-инструментов, но и специально организованными педагогическими условиями: включением AI в решение профессионально значимых задач, развитием критико-рефлексивного отношения к результатам генерации и опорой на практико-ориентированные формы работы. Практическая значимость исследования связана с возможностью использования полученных результатов при обновлении содержания педагогического образования.

Ключевые слова: искусственный интеллект, AI-грамотность, будущие педагоги, педагогические условия, высшее образование, квазиэксперимент.

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