RUDN Journal of Informatization in Education
Вестник РУДН. Серия: Информатизация образования
ISSN 2312-8631 (Print); ISSN 2312-864X (Online)
2025 Vol. 22 No. 2 195–208
http://journals.rudn.ru/informatization-education

DOI: 10.22363/2312-8631-2025-22-2-195-208
EDN: BUFBLX
UDC 378

Research article / Научная статья

The attitude of future teachers towards the use of generative artificial intelligence in solving professional tasks

Aleksandr I. Minakov[1,2], Svetlana V. Zenkina[3]

[1]*Moscow University of Humanities, Technology and Management, Moscow, Russian Federation*
[2]*Moscow Financial and Industrial University "Synergy", Moscow, Russian Federation*
[3]*Corporate University of Education Development, Mytishchi, Russian Federation*
✉am@infodrive.pro

Abstract. *Problem statement.* The integration of artificial intelligence (AI) into the field of education has become one of the key factors transforming pedagogical activities worldwide. The proliferation of generative AI tools (ChatGPT, DeepSeek, GigaChat) is accompanied by numerous discussions about their impact on the learning process and teachers' professional activities. Among the main challenges highlighted in the global academic literature are: 1) the lack of unified attitudes towards AI use; 2) insufficient digital literacy among participants in the educational process; and 3) ethical and long-term risks of applying AI in education. The aim of this study is to explore future teachers' attitudes towards the use of generative AI in solving professional tasks and to determine the impact of additional training on their perception of AI tools. *Methodology.* The empirical study involved 32 students pursuing a pedagogical profile. Surveys were conducted before and after completing an elective course on the use of AI in teachers' professional activities. Methods included self-assessment (attitude survey), analysis of survey data, and statistical processing of results using the Student's t-test to assess the significance of changes in future teachers' attitudes towards AI. *Results.* The significance of additional training for improving future teachers' attitudes towards AI has been confirmed. It was found that generative AI is perceived most positively in text generation tasks, while tasks involving assignment grading and generating video and audio materials inspire the least trust. The training helped reduce negative perceptions and improved the attitude towards using AI in solving professional tasks. *Conclusion.* The findings confirm the need for targeted training for future teachers in the fundamentals of AI to minimize negative aspects and ensure effective use of the technology. The developed principles could form the basis for creating educational disciplines and professional development courses, enabling more rational and safe applications of AI in education.

Keywords: neural networks, large language models, digital literacy, generative artificial intelligence, digital transformation of education, artificial intelligence in work of future

educators, problems of artificial intelligence, students' attitudes towards artificial intelligence, ChatGPT, DeepSeek, GigaChat, Perplexity

Author's contribution. The authors have made an equivalent contribution to the preparation of the publication.

Conflicts of interest. The authors declare that there is no conflict of interest.

Article history: received 13 October 2024; revised 10 December 2024; accepted 28 December 2024.

For citation: Minakov AI, Zenkina SV. The attitude of future teachers towards the use of generative artificial intelligence in solving professional tasks. *RUDN Journal of Informatization in Education.* 2025;22(2):195–208. http://doi.org/ 10.22363/2312-8631-2025-22-2-195-208

Отношение будущих педагогов к применению генеративного искусственного интеллекта в решении профессиональных задач

А.И. Минаков[1,2], С.В. Зенкина[3]

[1]*Московский гуманитарный университет технологий и управления, Москва, Российская Федерация*
[2]*Московский финансово-промышленный университет «Синергия», Москва, Российская Федерация*
[3]*Корпоративный университет развития образования, Мытищи, Российская Федерация*
✉am@infodrive.pro

Аннотация. *Постановка проблемы.* Внедрение искусственного интеллекта (ИИ) в сферу образования становится одним из ключевых факторов трансформации педагогической деятельности во всем мире. Распространение инструментов генеративного ИИ (ChatGPT, DeepSeek, GigaChat, Perplexity) сопровождается множеством дискуссий, связанных с его влиянием на процесс обучения и профессиональную деятельность педагогов. Среди основных проблем, выделяемых в мировой научной литературе, упоминаются: 1) отсутствие единого отношения к использованию ИИ; 2) недостаточная цифровая грамотность участников образовательного процесса; 3) этические и долгосрочные риски применения ИИ в образовании. Цель исследования заключается в изучении отношения будущих педагогов к использованию генеративного ИИ в профессиональных задачах, а также в выявлении влияния дополнительного обучения на восприятие инструментов ИИ. *Методология.* В эмпирическом исследовании приняли участие 32 обучающихся педагогического профиля. Проводилось анкетирование до и после прохождения элективного курса по применению ИИ в профессиональной деятельности педагога. Использовались методы самооценки (анкета отношения), проводился анализ данных анкетирования и статистическая обработка результатов с применением t-критерия Стьюдента для оценки значимости изменений в отношении будущих педагогов к ИИ. *Результаты* Подтверждена значимость дополнительного обучения для изменения отношения будущих педагогов к ИИ. Выявлено, что генеративный ИИ наиболее положительно воспринимается в задачах генерации текста, тогда как наименьшее доверие вызывают задачи проверки заданий и создание видео- и аудиоматериалов. Обучение способствовало снижению отрицательного отношения и улучшению восприятия использования ИИ в решении профессиональ-

ных задач. *Заключение.* Полученные результаты подтверждают необходимость целенаправленного обучения будущих педагогов основам работы с ИИ для минимизации негативных аспектов и эффективного использования технологий. Разработанные положения могут послужить основой для создания учебных дисциплин и курсов повышения квалификации, что позволит обеспечить более рациональное и безопасное применение ИИ в образовании.

Ключевые слова: нейросети, большие языковые модели, цифровая грамотность, генеративный искусственный интеллект, цифровая трансформация образования, искусственный интеллект в работе будущих педагогов, проблемы искусственного интеллекта, отношение студентов к искусственному интеллекту, ChatGPT, DeepSeek, GigaChat, Perplexity

Вклад авторов. Авторы внесли равный вклад в подготовку публикации.

Заявление о конфликте интересов. Авторы заявляют об отсутствии конфликта интересов.

История статьи: поступила в редакцию 13 октября 2024 г.; доработана после рецензирования 10 декабря 2024 г.; принята к публикации 28 декабря 2024 г.

Для цитирования: *Minakov A.I., Zenkina S.V.* The attitude of future teachers towards the use of generative artificial intelligence in solving professional tasks // Вестник Российского университета дружбы народов. Серия: Информатизация образования. 2025. Т. 22. № 2. С. 195–208. http://doi.org/10.22363/ 2312-8631-2025-22-2-195-208

Problem statement. The problem of using artificial intelligence (hereinafter referred to as AI) in education has become worldwide in the last few years. With the emergence of large language models (ChatGPT, DeepSeek, GigaChat, etc.) combined into generative AI tools, a significant quantitative growth of content produced with its use is registered[1]. We daresay a similar situation is happening in education, as many AI models today are free and publicly available.

In general, trends in thinking on the impact of AI on education have also swept the global community. There are many studies that theoretically or empirically reveal the debatable nature of AI and its impact on education. For example, Russian educational practice registers the absence of homogeneous attitude to AI and its perception, which is indicated, for example, by L.V. Konstantinova, V.V. Vorozhikhin, A.M. Petrov, E.S. Titova, and D.A. Shtykhno. The authors summarize that the topic of AI causes numerous discussions both among ordinary users, students, teachers, and experts. The survey conducted by the authors proved that there is no consensus on how AI affects education; nevertheless, an unambiguous conclusion is made

[1] PPC.world. *The amount of AI-generated content online has grown 17-fold in a year*. (In Russ.) https://ppc.world/news/za-god-v-onlayne-v-17-raz-vyroslo-kolichestvo-kontenta-sozdannogo-s-pomoschyu-ii/ (accessed: 27.11.2024); Trends.RBC. *How popular is AI really and does everyone use neural networks?* (In Russ.) https://trends.rbc.ru/trends/industry/6679501b9a79475b7722d64a (accessed: 27.11.2024); Synergy Times. *Research: By 2026, up to 90 % of online content will be generated by artificial intelligence*. (In Russ.) https://synergytimes.ru/be-aware/issledovanie-k-2026-godu-do-90-onlayn-kontenta-budet-generirovat-iskusstvennyy-intellekt (accessed: 27.11.2024)

about the enormous functional capabilities and further impact of AI on education [1]. E.A. Pospelova, P.L. Ototsky, E.N. Gorlacheva, and R.V. Faizullin come to similar conclusions emphasizing the following key challenges: dependence of the quality of AI use in education on digital literacy, uneven access, not always reliable operation of algorithms, concerns about the impact of AI in the long term on cognitive function [2]. The work of A.V. Rezaev, A.M. Stepanov, and N.D. Tregubova notes the transformational and interdependence-determining nature of the impact of AI on higher education [3]. In terms of evaluation (positive or negative) of AI in education, provisions are made for the disruptive and constructive features of the technology [4]. It is recognized that there are multiple perspectives on the application of large language models in education [5].

If we focus on the attitude of different subjects of the educational process to the use of AI, the controversy of the raised question is also manifested, as evidenced by the study conducted by K.I. Buyakova, Y.A. Dmitriev, A.S. Ivanova, A.V. Feshchenko, and K.I. Yakovleva. The authors compare the perception and attitude to AI tools in education from the position of learners (students) and teachers. A circumstance is formed in which different groups of subjects demonstrate different attitudes to AI. And although in general both groups consider the tool to be 'positive', a more cautious and concerned attitude towards AI is registered among teachers [6]. The study by I.A. Aleshkova, A.T. Gasparishvili, N.P. Narbut, O.V. Krukhmaleva, and N.E. Savina emphasizes that older students have a more critical and balanced attitude towards the AI [7]. Nevertheless, it is worth admitting that teachers demonstrate a much more skeptical attitude, and this has its own reasons. For example, the closed or unethical use of AI by students is becoming one of the fundamental problems in global education, for example, when performing control tasks aimed at testing theoretical knowledge. In general, it is obvious that all existing discussions about AI will lead to the fact that education will develop, and many practices and trends related to the organization of learning will be revised; a typical example is the need to change the systems and approaches to knowledge assessment, since generative AI already successfully solves many test tasks today.

So, in the light of the above discussions and the questions raised about the impact of AI on education, it is relevant to study the attitude of future teachers (students receiving higher pedagogical education) to the use of AI. The interest in this group is due to the fact that it is formally between the category of "student" and "teacher". Many students at the stages of education try themselves in different positions in education, teach private lessons or practice in educational organizations, including additional training (master's degree), which implies employment (current place of work) of the student in education.

Thus, the problem of future teachers' attitude to the use of generative AI in solving professional tasks and interest in it become especially acute in the light of the global spread and influence of AI on pedagogical activity all over the world. From the point of view of future teachers, the problematic of generative AI in education is determined by the readiness to use its capabilities in further professional activities. However, such a thing is impossible without systemic support and

training, development and expansion of ideas about AI as a tool in the hands of a modern educator. So, several objectives are pursued: to summarize the 'advantages' and 'disadvantages' of AI influence on education in the context of its quality and solution of professional tasks by teachers; to identify the attitude of future teachers to generative AI and its use in their work; to clarify the role of additional education and experimentally assess its influence on the attitude of future teachers to AI in the context of minimizing the 'negative' aspects of AI in education.

Methodology. The research was conducted in several stages. At the first stage, the problem was formulated and the objectives of the study were defined, in accordance with which the range of issues requiring resolution was outlined. At the second stage, the literature was collected and analyzed, and a bibliographic description was carried out, that allowed to systematize the main ideas and provisions on the issues of improving the effectiveness and attitude of students (future teachers) to AI in education. When working with the literature, general scientific methods were used (comparative analysis, description, synthesis, generalization). Graphic visualization was applied, too.

In parallel, an entrance survey of 32 students – future teachers was conducted, which allowed to clarify and generalize the current attitude to the use of AI in solving professional tasks. All the students subsequently took additional training (elective course) on the use of AI in professional tasks of a teacher (on the basis of the Moscow Financial and Industrial University "Synergy"). The implementation of the elective course and the elaboration of its content were grounded in A.I. Minakov's early developments and the content of the working program of the discipline "AI and Neural Networks in the Project Activity of Primary Education Teacher", covered in previous studies [8]. The notes were also used and later transformed into a textbook on AI and neural networks in education [9].

The additional training took five months, after which the trainees (in the same number) were questioned again about their attitudes towards AI in professional tasks. The questionnaire itself did not change at the input and output stages. It was formed according to the principles of trainees' self-assessment of their attitudes to certain AI tools and their application in professional tasks (on a five-point scale, where "0" – have not heard, "1" – have heard, but have not tried, "2" – have tried, but do not use, "3" – rarely use, "4" – regularly use, "5" – actively use and teach others). In total, the questionnaire highlighted six questions delineated by functional areas of generative AI application in education and educator's professional task solving: (1) generation of images, (2) generation of text (essay topics, lecture material), (3) creation of a set of assessment materials (tests, case studies, etc.), (4) generation of audio and video files, (5) checking students' assignments, and (6) use in research work.

Thus, the empirical part of the study included the obtained results of taking the questionnaire before and after the additional AI training (input and output data, respectively). To assess the statistical significance of the obtained results and the observed improvements, Student's t-criterion was applied to clarify the role of additional education and its impact on future teachers' attitudes towards AI in the context of minimizing the 'negative' aspects of AI in education.

Results and discussion. Carrying out a critical analysis of the attitudes of teachers (educators), students and students studying in the direction of teacher education confirms a significant divergence and discussion of views on AI in education from the position of each of the named subjects. Thus, the most popular opinion in Russian scientific research is that AI in education needs regulation and more systemic control. For example, E.N. Ivakhnenko and V.S. Nikolsky tell about a well-known in Russia case of a student's non-self-autonomous writing of a final qualification paper through generative AI, which passed successful checks and after a number of minor revisions was accepted for defense. The authors believe that AI will radically change the perception of traditional concepts of "knowledge", "cognition" and "learning", in which they rely on the range of issues traditionally associated with AI – physical limitations of technologies, algorithmic errors, limited access, as well as the ethics of using AI in education and science [10]. Among other things, as A.D. Zhukov writes, the problem of dependence and consequences of AI implementation "for the future" remains relevant; if the technology takes a systemic importance in education, its rejection may lead to irreversible negative consequences [11]. According to D.V. Aleynikova, when considering AI and its impact on education, it is more appropriate to focus on the two-sided nature of AI. Since the processes of AI penetration into education are already irreversible, the author calls for expanding the benefits available to teachers and learners from the correct use of AI. This is why it is necessary to consider AI not only as a technical innovation, but also as a tool reflected in the 'human' dimension. As a result, it is noted that it is necessary to develop modern students' skills in using AI, to expand their understanding of the mechanisms and principles of its operation, to develop skills to critically evaluate and verify the results of AI work, and to optimally choose AI tools for solving professional tasks [12].

It is noteworthy that similar conclusions are drawn by scholars around the world. For example, the Chinese authors C.K.Y. Chan and L.H.Y. Tsi noted that despite the popularity of AI among students, the latter are interested in learning with humans. Students believe that human teachers are characterized by a number of unique qualities – they are creative, emotional, and possess social competencies. It is highlighted that since generative AI is unable to demonstrate such qualities, its application in education is limited to its instrumental nature. AI becomes a tool for learning and improving the educational process, expanding its capabilities [13]. Similarly, a group of authors conducting a study of students' attitudes towards generative AI in Ghana concluded that future educators have moderately positive attitudes towards generative AI. It is perceived by them as a tool for working with information; the key concern of future educators becomes the accuracy and reliability of the performance of AI outputs [14].

As for existing educators, for example, in the United States the attitude towards AI is positive-medium (3.99 out of 5), which is justified by the 'outweighing' of AI advantages over disadvantages. Advantages include speeding up routines, generating ideas, personalizing and supporting learning, while disadvantages include reduced creativity, generic work, and impact on honesty and autonomy of work completion [15]. Another study, also conducted in the US, assessed current educators'

perceptions of the potential of AI in school education, noting that educators view the advantages and disadvantages of AI from both perspectives. Many features of AI are seen as both an advantage and a disadvantage. For example, AI's lack of emotion is an advantage in tasks that require impartiality and objectivity; at the same time, in situations of assessing complex human behavior, AI's lack of emotion is a disadvantage and a problem [16]. Finally, it is important to refer to the results of a study that compared teachers' attitudes toward AI in education from six countries, including Brazil, Israel, Japan, Norway, Sweden, and the United States. The study focused on teachers' perceptions of the advantages and disadvantages of AI technologies in education, revealing some country differences. For example, teachers from Brazil, Israel, and Japan showed greater confidence in AI in education compared to colleagues from Norway, Sweden, and the US. At the same time, all teachers were about equally likely to mention similar advantages and disadvantages of AI in education, key barriers to its use [17].

So, concretizing and summarizing the current experience and empirical research on the attitudes of teachers, students and future educators towards AI in education, we can draw several important conclusions.

First, there are differences in the perception of AI between teachers, students and future educators. Thus, predominantly, teachers see AI as a useful tool for overcoming routine in their work, but a more careful and wary attitude towards AI is registered. Students generally have a positive perception of AI as they see it as a way to speed up their work with information; there is a need for a human teacher and a lack of interest in replacing teachers with AI assistants. In fact, future educators have taken a more in-between position in relation to AI in education, between educators and students; they actively use AI as a helper to learn complex topics, prepare for classes and find learning resources, but also address the ethics of using AI, the need for rigorous supervision, and are interested in preserving the value of human relationships in education.

Second, approaches to the perception of AI in education directly depend on the specific country in which the study was conducted, that probably comes from the influence of cultural, economic, and social factors, as well as the peculiarities of the established educational system. For example, in the USA and Northern Europe, special attention is paid to the ethics and long-term consequences of the impact of AI on education; in Asia, AI is seen as a partner and personal assistant in learning; in Russia, Brazil, and Ghana, a positive attitude towards AI is emphasized more by students and future teachers, as teachers are characterized by a more cautious attitude.

Third, regardless of country specificity, there is an awareness of the general positive and negative aspects of using AI in education, which are summarized as follows (Figure 1). At the same time, one cannot ignore the fact that many of the concerns or shortcomings associated with AI in education come from the influence of the human factor. Potentially, they can be eliminated by human efforts with a more rational, balanced and critical attitude to the results of generative AI and its algorithms. This circumstance emphasizes the expediency of organizing training of different categories of respondents in more effective application of AI in education.

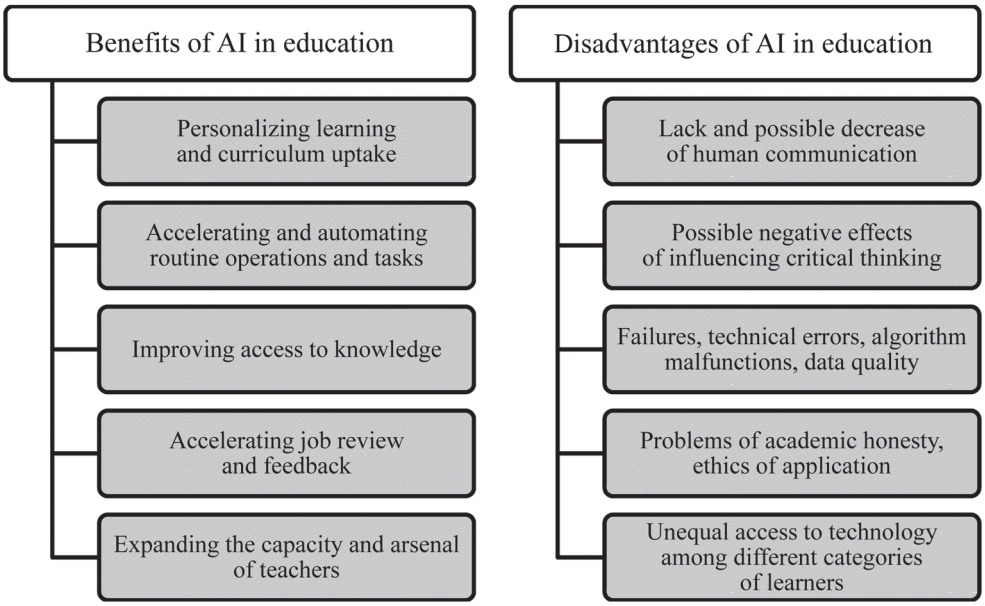

Figure 1. Advantages and disadvantages of AI in learning as reported by different groups of respondents

Source: compiled by Aleksandr I. Minakov, Svetlana V. Zenkina.

In order to concretize the conclusions made, let us present the results of our own empirical research, the purpose of which was to find out the attitude of students (future teachers) to the application of AI in education and solving professional tasks. We developed a questionnaire consisting of six questions devoted to the application of generative AI in professional tasks (in education). The survey showed the following distribution of respondents' self-assessments at the input stage (Table 1).

Table 1

Results of the entrance questionnaire survey of students (future teachers) on attitudes towards generative AI in professional tasks

No.	Question	"0"	"1"	"2"	"3"	"4"	"5"
1	What's your take on AI and neural networks for image generation?	0.00 %	31.25 %	9.38 %	34.38 %	6.25 %	18.75 %
2	What's your attitude towards AI and neural networks for text generation (essay topics, lecture material)?	3.12 %	15.62 %	9.38 %	25 %	21.88 %	25 %
3	What's your attitude towards AI and neural networks to create a set of assessment materials (tests, cases, etc.)?	21.88%	25%	9.38%	28.12%	12.5%	3.12%
4	What's your take on AI and neural networks for generating video and audio?	18.75%	43.75%	15.62%	9.38%	6.25%	6.25%
5	What's your take on AI and neural networks for checking students' assignments?	34.38%	34.38%	3.12%	18.75%	3.12%	6.25%
6	What's your take on AI and neural networks for research and development?	6.25%	18.75%	6.25%	37.5%	15.62%	15.62%

Source: compiled by Aleksandr I. Minakov, Svetlana V. Zenkina.

Based on the presented data, characteristic conclusions can be drawn for each block of questions of the entrance survey.

Question no. 1. Image generation is rather positively perceived, although not all highly rated, which is reflected in the frequency of use (34.38 % – rarely use, 6.25 % – regularly use, and 18.75 % – actively use). Nevertheless, more than a third of the respondents (31.25 %) are familiar with the technology but have not tried it, which indicates that the tool is not sufficiently integrated into students' professional tasks.

Question no. 2. Text generation is perceived as a useful tool, and its usefulness is greater than that of image generation, as evidenced by the high level of regular (21.88 %) and active (25 %) use.

Question no. 3. The idea of using AI to prepare assessment materials is perceived more skeptically. Although 28.12 % use the tool rarely, only 12.5 % use it regularly, and 3.12 %, actively. It is noteworthy that a significant proportion of respondents (21.88 %) are either not familiar with the feature or have heard of it but have not tried (25 %), that indicates the need for popularization and training.

Question no. 4. Generation of video and audio by AI is also assessed skeptically. The majority (43.75 %) have heard of this possibility but have not tried it. Only a small proportion of students use the technology (9.38 % – rarely, 6.25 % – regularly, and 6.25 % – actively), that indicates poor penetration of the technology and lack of confidence in it.

Question no. 5. Checking tasks with AI does not inspire confidence among respondents. More than a third of respondents (34.38 %) have either not heard of this feature or have heard of it but have not tried (34.38 %). Only 3.12 % use the tool regularly, while 6.25 % are actively using it.

Question no. 6. AI is assessed at a reserved but positive level – the potential for use remains. Some respondents actively (15.62 %) or regularly (15.62 %) use the tool. Almost 37.5 % indicate infrequent use, pointing that there is interest and potential for integrating AI into scientific activities.

Thus, the typical manifestations of future teachers' attitude to the application of generative artificial intelligence in solving professional tasks are: restraint, division of technologies into 'trusting' and 'low-trust'. The most positive perception of generative AI in solving professional tasks can be traced in the generation of texts while the most negative, in the generation of video and audio, as well as in the verification of tasks.

Taking into account the results obtained in the input questionnaire, the respondents were provided with training: they took an elective course, the structure of which was divided into six sections corresponding to the presented groups of questions. The conducted training in general showed quite productive and statistically significant results, which was confirmed in the evaluation through Student's t-test. The following hypothesis was set: additional education influences future teachers' attitude to AI in the context of minimizing the 'negative' aspects of AI in education.

To test the hypothesis, a paired t-test was conducted to assess statistically significant changes in future educators' attitudes toward the use of AI before (input questionnaire) and after (output questionnaire) the completed training on six blocks of questions (Table 2).

Table 2

Student's t-test in the context of evaluating the results of training future teachers in the application of generative AI in professional tasks

A question related to the attitude	Arithmetic average	Standard deviation	Error of averages	T-test	P-value
Attitudes towards AI and neural networks for image generation	1.31	1.12	0.20	6.63	2.07×10^{-7}
Attitudes towards AI and neural networks for text generation (essay topics, lecture material)	0.81	1.35	0.24	3.39	1.90×10^{-3}
Attitudes towards AI and neural networks to create a set of assessment materials (tests, cases, etc.)	1.47	1.63	0.29	5.11	1.57×10^{-5}
Attitudes towards AI and neural networks for video and audio generation	1.44	1.24	0.22	6.54	2.64×10^{-7}
Attitudes towards AI and neural networks for checking students' assignments	1.50	1.65	0.29	5.15	1.38×10^{-5}
Attitudes towards AI and neural networks for research and development activities	1.56	1.58	0.28	5.58	1.38×10^{-5}

Source: compiled by Aleksandr I. Minakov, Svetlana V. Zenkina.

The results obtained were disclosed in the context of several critical levels of significance. We note that the results were highly significant, since at $\alpha = 0.001$ the null hypothesis of no change in the sample is rejected with an extremely high value (probability of error – 0.1 %).

For better visual perception, we present the comparative results graphically (Figure 2).

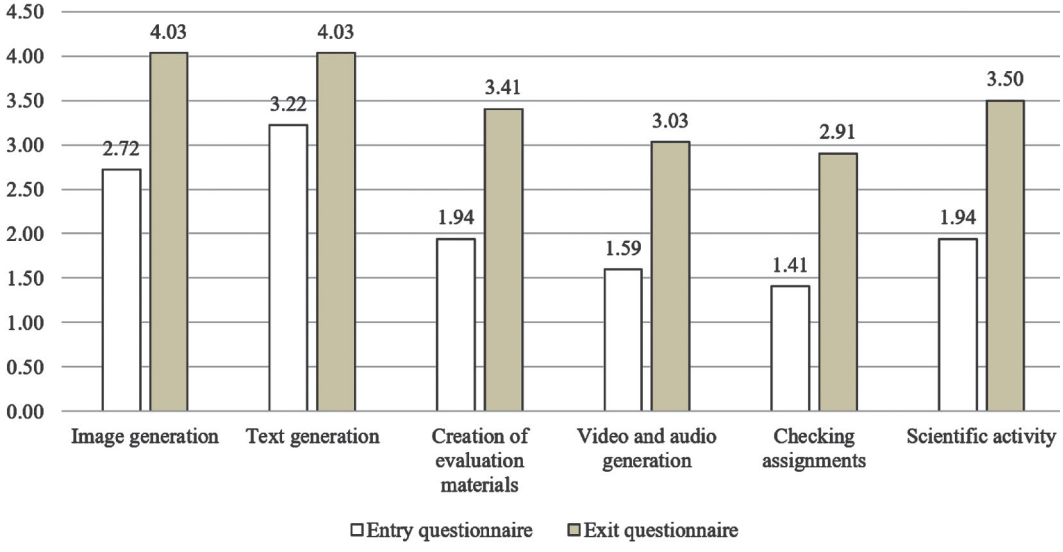

Figure 2. The mean values of future educators' attitudes toward various aspects of AI usage before and after the implementation of the supplementary education program

Source: created by Aleksandr I. Minakov, Svetlana V. Zenkina.

Thus, the change is manifested in each of the aspects of using AI in the professional tasks of future teachers. It is possible to state the openness and possibility of improving their attitude to AI in education through the development

of additional training programs such as elective courses, professional development courses, following the results of structured self-study, etc. The prospect of such work is also manifested at the level of its scaling to combat problems, minimize negative manifestations and maximize the benefits of AI – therefore, it is recommended to build work with a focus on overcoming the most pronounced prejudices and negative attitudes towards AI. At the same time, based on the previously cited scientific literature, it is possible to specify the need to work on the content of AI training, in what it is possible to form future teachers' ideas about the most significant limitations, peculiarities of work, and variations in the use of AI as a complementary tool to human activity.

Conclusion. The conducted research allows us to theoretically confirm the differences in the perception and attitude of future teachers to the application of AI in professional tasks, as well as the presence of differences in the attitude to generative AI among teachers, students, and future teachers (students of teacher education). It can be summarized that AI will continue its active penetration into education – these processes are inevitable and have already been launched. Therefore, it is more advisable to change the vector of research devoted to AI from generalizing the contradictions, advantages or disadvantages of AI to developing recommendations, methodological materials or other useful practical tools that will allow more effective, rational, safe and critical application of AI in solving professional tasks of both future and already working teachers.

In addition, an important direction for improving the attitude of future teachers to AI in education is their targeted training, which should be based on the principles of awareness raising, disclosure of algorithms and principles of AI operation, issues of safe use, as well as application in specific professional tasks: in generation of images in teaching, generation of texts, creation of assessment materials, generation of video and audio materials, automatic verification of assignments, and scientific activities. In addition, the study allowed us to once again emphasize the conclusions made earlier (in previous studies) about the need for gradual integration of AI into teachers' activities in order to improve its effectiveness, which should be accompanied by the development of training programs, professional development courses, as well as the integration of academic disciplines devoted to AI in education and solving professional tasks of teachers into the cycle of subject training of future teachers.

References

[1] Konstaninova LV, Vorozhikhina VV, Petrova AM, Titova ES, Shtykhno DA. Generative artificial intelligence in education: discussions and forecasts. *Open Education*. 2023;27(2):36–48. (In Russ.) https://doi.org/10.21686/1818-4243-2023-2-36-48

[2] Pospelova EA, Ototsky PL, Gorlacheva EN, Faizullin RV. Generative artificial intelligence in education: current trends and prospects. *Vocational Education and Labour Market*. 2024;12(3):6–21. (In Russ.) https://doi.org/10.52944/PORT.2024.58.3.001

[3] Rezaev AV, Stepanov AM, Tregubova ND. Higher education in the age of artificial intelligence. *Higher Education in Russia*. 2024;33(4):49–62. (In Russ.) https://doi.org/10.31992/0869-3617-2024-33-4-49-62

[4] Subbotina MV. Artificial intelligence and higher education – enemies or allies. *RUDN Journal of Sociology*. 2024;24(1):176–183. (In Russ.) https://doi.org/10.22363/2313-2272-2024-24-1-176-183

[5] Raitskaya LK, Lambovska MR. Prospects for ChatGPT application in higher education: a scoping review of international research. *Integration of Education*. 2024;28(1):10–21. (In Russ.) https://doi.org/10.15507/1991-9468.114.028.202401.010-021

[6] Buyakova KI, Dmitriev YaA, Ivanova AS, Feshchenko AV, Yakovleva KI. Students' and teachers' attitudes towards the use of tools with generative artificial intelligence at the university. *The Education and Science Journal*. 2024;(7):160–193. (In Russ.) https://doi.org/10.17853/1994-5639-2024-7-160-193

[7] Aleshkovski IA, Gasparishvili AT, Narbut NP, Krukhmaleva OV, Savina NE. Russian students on the potential and limitations of artificial intelligence in education. *RUDN Journal of Sociology*. 2024;24(2):335–353. (In Russ.) https://doi.org/10.22363/2313-2272-2024-24-2-335-353

[8] Minakov AI. Artificial intelligence in education is a current direction in the training of modern teachers. *World of Science. Pedagogy and Psychology*. 2024;12(1):65PDMN124. (In Russ.) https://mir-nauki.com/PDF/65PDMN124.pdf

[9] Minakov AI. *Artificial intelligence and neural networks in education: teaching aid*. Moscow: Direct-Media; 2024. (In Russ.)

[10] Ivakhnenko EN, Nikolskiy VS. ChatGPT in higher education and science: a threat or a valuable resource? *Higher Education in Russia*. 2023;32(4):9–22. (In Russ.) https://doi.org/10.31992/0869-3617-2023-32-4-9-22

[11] Zhukov AD. Generative artificial intelligence in the educational process: challenges and prospects. *The Bulletin of Moscow State University of Culture and Arts*. 2023;5:66–75. (In Russ.) https://doi.org/10.24412/1997-0803-2023-5115-66-75

[12] Aleynikova DV. Artificial intelligence in teaching and learning: revisiting the problem of educational product quality. *Vestnik of Moscow State Linguistic University. Education and Teaching*. 2023;4:16–20. (In Russ.)

[13] Chan SKY, Tsi LHY. Will generative AI replace teachers in higher education? A study of teacher and student perceptions. *Studies in Educational Evaluation*. 2024;83:101395. https://doi.org/10.1016/j.stueduc.2024.101395

[14] Nyaaba M, Shi L, Nabang M, Zhai X, Kyeremeh P, Ayoberd SA, Akanzire BN. Generative AI as a learning buddy and teaching assistant: Pre-service teachers' uses and attitudes. *ArXiv* [Preprint] 2024. https://doi.org/10.48550/arXiv.2407.11983 (accessed: 30.11.2024)

[15] Ghimire A, Prather J, Edwards J. Generative AI in education: A study of educators' awareness, sentiments, and influencing factors. *ArXiv* [Preprint] 2024. https://doi.org/10.48550/arXiv.2403.15586 (accessed: 30.11.2024)

[16] Oh S, Ahn Y. Exploring teachers' perception of artificial intelligence: The socio-emotional deficiency as opportunities and challenges in human-AI complementarity in K-12 education. *ArXiv* [Preprint] 2024. https://doi.org/10.48550/arXiv.2405.13065 (accessed: 30.11.2024)

[17] Viberg O, Cukurova M, Feldman-Maggor Y, Alexandron G, Shirai S, Kanemune S et al. What explains teachers' trust in AI in education across six countries? *International Journal of Artificial Intelligence in Education*. 2024. https://doi.org/10.1007/s40593-024-00433-x

Список литературы

[1] *Константинова Л.В., Ворожихин В.В., Петров А.М., Титова Е.С., Штыхно Д.А.* Генеративный искусственный интеллект в образовании: дискуссии и прогнозы // Открытое образование. 2023. Т. 27. № 2. С. 36–48. https://doi.org/10.21686/1818-4243-2023-2-36-48

[2] *Поспелова Е.А., Отоцкий П.Л., Горлачева Е.Н., Файзуллин Р.В.* Генеративный искусственный интеллект в образовании: анализ тенденций и перспективы // Профессиональное образование и рынок труда. 2024. Т. 12. № 3. С. 6–21. https://doi.org/10.52944/PORT.2024.58.3.001

[3] *Резаев А.В., Степанов А.М., Трегубова Н.Д.* Высшее образование в эпоху искусственного интеллекта // Высшее образование в России. 2024. Т. 33. № 4. С. 49–62. https://doi.org/10.31992/0869-3617-2024-33-4-49-62

[4] *Субботина М.В.* Искусственный интеллект и высшее образование – враги или союзники // Вестник РУДН. Серия: Социология. 2024. Т. 24. № 1. С. 176–183. https://doi.org/10.22363/2313-2272-2024-24-1-176-183

[5] *Раицкая Л.К., Ламбовска М.Р.* Перспективы применения ChatGPT для высшего образования: обзор международных исследований // Интеграция образования. 2024. Т. 28. № 1. С. 10–21. https://doi.org/10.15507/1991-9468.114.028.202401.010-021

[6] *Буякова К.И., Дмитриев Я.А., Иванова А.С., Фещенко А.В., Яковлева К.И.* Отношение студентов и преподавателей к использованию инструментов с генеративным искусственным интеллектом в вузе // Образование и наука. 2024. Т. 26. № 7. С. 160–193. https://doi.org/10.17853/1994-5639-2024-7-160-193

[7] *Алешковский И.А., Гаспаришвили А.Т., Нарбут Н.П., Крухмалева О.В., Савина Н.Е.* Российские студенты о возможностях и ограничениях использования искусственного интеллекта в обучении // Вестник РУДН. Серия: Социология. 2024. Т. 24. № 2. С. 335–353. https://doi.org/10.22363/2313-2272-2024-24-2-335-353

[8] *Минаков А.И.* Искусственный интеллект в образовании – актуальное направление подготовки современных педагогов // Мир науки. Педагогика и психология. 2024. Т. 12. № 1. https://mir-nauki.com/PDF/65PDMN124.pdf

[9] *Минаков А.И.* Искусственный интеллект и нейросети в образовании : учебное пособие. М. : Директ-Медиа, 2024. 156 с.

[10] *Ивахненко Е.Н., Никольский В.С.* ChatGPT в высшем образовании и науке: угроза или ценный ресурс? // Высшее образование в России. 2023. Т. 32. № 4. С. 9–22. https://doi.org/10.31992/0869-3617-2023-32-4-9-22

[11] *Жуков А.Д.* Генеративный искусственный интеллект в образовательном процессе: вызовы и перспективы // Вестник Московского государственного университета культуры и искусств. 2023. № 5 (115). С. 66–75. https://doi.org/10.24412/1997-0803-2023-5115-66-75

[12] *Алейникова Д.В.* Искусственный интеллект в преподавании и учении: к вопросу о качестве образовательного продукта // Вестник Московского государственного лингвистического университета. Образование и педагогические науки. 2023. Вып. 4 (849). С. 16–20.

[13] *Chan S.K.Y., Tsi L.H.Y.* Will generative AI replace teachers in higher education? A study of teacher and student perceptions // Studies in Educational Evaluation. 2024. Vol. 83. Article no. 101395. https://doi.org/10.1016/j.stueduc.2024.101395

[14] *Nyaaba M., Shi L., Nabang M., Zhai X., Kyeremeh P., Ayoberd S.A., Akanzire B.N.* Generative AI as a learning buddy and teaching assistant: Pre-service teachers' uses and attitudes // ArXiv (препринт). 2024. https://doi.org/10.48550/arXiv.2407.11983 (дата обращения: 30.11.2024)

[15] *Ghimire A., Prather J., Edwards J.* Generative AI in education: A study of educators' awareness, sentiments, and influencing factors // ArXiv (препринт). 2024. https://doi.org/10.48550/arXiv.2403.15586 (дата обращения: 30.11.2024)

[16] *Oh S., Ahn Y.* Exploring teachers' perception of artificial intelligence: The socio-emotional deficiency as opportunities and challenges in human-AI complementarity in K-12 education // ArXiv (препринт). 2024. https://doi.org/10.48550/arXiv.2405.13065 (дата обращения: 30.11.2024)

[17] *Viberg O., Cukurova M., Feldman-Maggor Y., Alexandron G., Shirai S., Kanemune S. et al.* What explains teachers' trust in AI in education across six countries? // International Journal of Artificial Intelligence in Education. 2024. https://doi.org/10.1007/s40593-024-00433-x

Bio notes:

Aleksandr I. Minakov, Teacher, Moscow University of Humanities, Technology and Management, 15/2 Pervoy Mayovki Alley, Moscow, 111395, Russian Federation; postgraduate researcher, Faculty of Pedagogy and Psychology, Moscow Financial and Industrial University "Synergy", 80B/5 Leningradsky Prospect, Moscow, 125315, Russian Federation. ORCID: 0009-0004-7584-4467. SPIN-code: 1073-5416. E-mail: am@infodrive.pro

Svetlana V. Zenkina, Doctor of Pedagogical Sciences, Professor at the Department of Natural and Mathematical Disciplines, Corporate University of Education Development, 13 Industrialnaya St, Mytishchi, 141006, Russian Federation. ORCID: 0000-0001-8458-4426. SPIN-code: 5647-8718. E-mail: svetlana_zenkina@mail.ru

Сведения об авторах:

Минаков Александр Игоревич, преподаватель, Московский гуманитарный университет технологий и управления, Российская Федерация, 111395, Москва, аллея Первой Маевки, д. 15, стр. 2; аспирант-исследователь, факультет Педагогики и психологии, Московский финансово-промышленный университет «Синергия», Российская Федерация, 125315, Москва, Ленинградский пр., д. 80Б, корп. 5. ORCID: 0009-0004-7584-4467. SPIN-код: 1073-5416. E-mail: am@infodrive.pro

Зенкина Светлана Викторовна, доктор педагогических наук, профессор кафедры естественно-математических дисциплин, Корпоративный университет развития образования, Российская Федерация, 141006, Мытищи, ул. Индустриальная, д. 13. ORCID: 0000-0001-8458-4426. SPIN-код: 5647-8718. E-mail: svetlana_zenkina@mail.ru