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Use of Artificial Intelligence in Teacher Training

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ABSTRACT

The purpose of the study is to consider the issue and identify problems with the introduction of artificial intelligence in education and, in particular, teacher training. The study is based on online questionnaires that were sent to teachers (375 people) of higher educational institutions and schools in Russia and China. The results of the study suggest that teacher training based on artificial intelligence can improve students' knowledge, but at this stage, the use of technology should be combined with the traditional learning approach. The research may be of interest to teachers, students, parents, school, and university administrations, as well as to a wide range of people interested in modern education trends. The results obtained with the help of this study can be considered when planning a strategy for introducing artificial intelligence into education, making decisions about its share in learning with due regard to a specific area of study.

KEYWORDS

artificial intelligence, automation of the educational process, new technologies in education, SDGs, teacher training, transformation of teaching

INTRODUCTION

Today artificial intelligence is developing at an increasingly fast pace and is being introduced into almost all areas of people's life (Yang et al., 2021). Thus, in 2020, the volume of investment in artificial intelligence technologies increased by 40% and amounted to $ 67.9 billion (TAdviser, 2021). Education also does not stand aside. Artificial intelligence represents an emerging domain of prospects conducive to the enhancement of teacher preparation, as asserted by Karsenti (2019) and expounded upon by Nichols and Holmes (2018). The issue of creating robots that can replace teachers is being actively discussed in the scientific community (Roll & Wylie, 2016). At the moment, software developers are not ready to develop computer systems that would fully meet the requirements of the education sector as there are still problems with the recognition of human speech by robots, imitation of thinking processes, etc.; however, artificial intelligence can be partly used in education, in particular teacher training. Today, such methodologies include the use of search engines and their

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various functions, electronic translators, computing systems, virtual reality, educational computer games, etc. (Tegmark, 2017).

The Covid-19 pandemic showed the need for wider application of technology in education as the need for distance learning arose (Al-Zyoud, 2020; TAdviser, 2021). Since 2020, teachers have been actively using remote work software platforms (for example, Zoom), various teaching tools and websites (Moodle, iSpring, Edmodo, GoogleClassroom).

Artificial intelligence relates to anything that can cope with non-routine tasks at a human level or better than a human level. For example, traffic cameras and security systems. The algorithms behind each technology are unique. To date, experts are improving the following functions of artificial intelligence in the field of education: a tutor (one-on-one instruction, selection of a learning route), automatic assessment of the knowledge, analysis of student behaviour (reasons for absenteeism, the emotional and physical state of a person). Also, artificial intelligence can collect and process data of the participants in the educational process (success, grades, characteristics, etc.). With the help of artificial intelligence tools, students can learn foreign languages, medicine and other sciences; today many services can provide feedback to the student (Duggan, 2020; Kong, 2020; Mustafa & Garcia, 2021).

Today in most countries of the world, including Russia and China, traditional education prevails. However, technology is becoming increasingly important in the educational process. Thus, in 2017, 800 universities placed about 9,000 training courses on various educational platforms. Computers are expected to almost completely replace teachers in the coming years. Despite the differences between human and artificial intelligence, scientists see the potential to facilitate and improve education in both traditional (face-to-face) learning and blended/online learning (González-Calatayud et al., 2021; Kumar, 2019).

Rising teachers, like other students, can be taught with the use of artificial intelligence. In particular, machines could manage planning, accounting, content optimization, student grading, and other functions. Teaching today requires good communication skills, knowledge in the field of psychology (the ability to recognize emotions, take into account individual abilities, knowledge of the principles of motivation, etc.) and experience in communicating with people. For this reason, many professionals are sceptical about the use of artificial intelligence in teacher training. Today a partial transfer of responsibilities to artificial intelligence rather than a complete transition to this type of training is being considered.

Digital technologies began to be widely applied in education in 2020, and today some conclusions can already be made (assess the knowledge of students, collect the opinions of teachers, compare the results with the data until 2020, etc.). There are no effective robot teachers yet, but artificial intelligence is already actively used to solve specific problems (administrative work, assessment, etc.).

To assess the possibility and potential effectiveness of the introduction of artificial intelligence in teacher training, it is necessary, first of all, to find out the opinion of education professionals. The study aims to clarify the situation with the use of modern technology (in particular, artificial intelligence) in educational institutions in Russia and China and assess the prospects for its wider implementation in the coming years. The Rationale for Conducting the Research:

1. Relevance of the Topic: The integration of digital technologies and artificial intelligence into education stands as a pivotal trend within the contemporary educational landscape. Consequently, there arises a compelling need to investigate the effectiveness and potential applications of these technologies in the preparation of pedagogical professionals.
2. The novelty of the Process: The integration of digital technologies and artificial intelligence into the realm of education constitutes a nascent phenomenon, with numerous facets of its implementation yet to be thoroughly explored. As such, research within this domain holds significant significance in identifying potential challenges and avenues for their resolution.

3. Advancement of Educational Excellence: The incorporation of artificial intelligence into pedagogical education presents the opportunity to enhance educational processes, customize learning experiences according to individual student requirements, and elevate the overall standard of education.
4. Process Refinement: The examination in question is poised to uncover pathways for refining educational procedures through the infusion of digital technologies. This prospect has the potential to mitigate the temporal and resource expenses associated with pedagogical staff preparation, while simultaneously fostering the enhancement of their expertise and qualifications.

On the whole, the conduct of research within the domain of digital technology integration and artificial intelligence in pedagogical education bears significant societal relevance, with the potential to contribute to the amelioration of educational quality and the cultivation of highly skilled educators.

Literature Review

Today, in several educational institutions, artificial intelligence is already fulfilling some of the functions previously performed by teachers. Artificial intelligence facilitates educators in executing diverse administrative tasks, including the more streamlined assessment and evaluation of student assignments, leading to enhanced outcomes and an elevation in the standard of pedagogy (Chen et al., 2020; Humble & Mozelius, 2019; Langley, 2019).

There is such a direction as Artificial Intelligence in Education (AIED). AIED ranges from personalized AI-driven turn-by-turn conversational and teaching systems to research education that uses artificial intelligence, student writing processing, and intelligent play assistants based on learning environments and chatbots to support learners, to connect students and teachers with the help of artificial intelligence, which allows students to manage their studies. It also includes student interactions with computers, general school approaches, students using smartphones outside of school, and more. In addition to the above, AIED can contribute to the creation of new methods of teaching and learning (Holmes et al., 2019).

Today many educators are not familiar with the concept of artificial intelligence and the technologies it is based on. They prioritize socio-cultural and technical knowledge about artificial intelligence slightly more than solely practical competencies.

Artificial intelligence can cope with the development of curricula in schools and universities in Hong Kong. When exploring the artificial intelligence approach to curriculum development, Self-Determination Theory (SDT) and the four basic approaches to curriculum planning (content, product, process, and practice) were used as a theoretical ground to explain the objectives and results of the research (Chiu & Chai, 2020).

For the introduction of artificial intelligence in education to be more effective, scientists from the UAE recommend the following measures to be taken: develop educational software based on artificial intelligence to improve the qualifications of teachers; create curricula based on artificial intelligence for all those involved in education; provide accurate databases in all fields of education, including human resources; create a learning environment that enhances the role of artificial intelligence applications in the professional development of teachers; link databases across the global network to transform teachers' career paths (Al-Zyoud, 2020).

The Use of Artificial Intelligence in Certain Fields of Science and Education

Art. The process of teaching art (for example, painting) involves the transfer of a large number of aspects of professional knowledge, especially when teaching highly professional skills and methods; the traditional approach to teaching art makes it more difficult to demonstrate the key points or links to all students and, therefore, there is a need for artificial intelligence to be introduced (Kong, 2020).

Foreign languages. Language learning is one of the most successful areas of artificial intelligence application. Along with the introduction of an expert system in artificial intelligence, the system has

created a learning approach so that students can double the learning effect provided that only 50% of the effort is made.

Computational linguistics. Natural Language Processing (NLP) is an engineering field dedicated to the design and implementation of computer systems primarily aimed at natural language analysis (Goksel & Bozkurt, 2019).

Medicine. New healthcare decision-making processes and innovative AI-powered protocols can make diagnosis and treatment decisions by analyzing complex datasets (Sapci & Sapci, 2020).

It is important to introduce teaching the basics of these technologies into the curriculum of educational institutions. Artificial intelligence lessons should:

- Focus on a systems perspective that shows the interaction of mechanisms to create knowledge;
- Allow students to code representative content;
- Introduce topics in conjunction with newer information overlaying the content studied before;
- Teach students not only to use artificial intelligence methods but also to create them from simple components;
- Cover important abilities of human intelligence (Langley, 2019).

Setting Objectives

The motive for conducting the study is the increasingly widespread introduction of digital technologies and artificial intelligence in the field of education and the emergence of numerous questions related to its effectiveness. In connection with the novelty of this process and the transition to its active introduction in 2020-2021, there is a need to study various aspects related to its implementation (pedagogical, psychological, technological, etc.). The present study focuses on the use of artificial intelligence in teacher training.

The purpose of the research is to examine the situation and identify the problems of introducing digital technologies and artificial intelligence in teacher education and training. The research endeavours to elucidate the effectiveness and prospective application of artificial intelligence in the training of teachers and other pedagogical personnel. The study delves into the realm of machine learning, a pivotal facet within artificial intelligence, which concentrates on the formulation of algorithms and models that empower computers to acquire knowledge from experience and data, thereby facilitating their adaptation to emerging scenarios.

The objectives of the research are to examine the situation with the introduction of technologies in education, to reveal the possibility of their use in teacher training, and to identify options to optimize the processes.

METHODS AND MATERIALS

Research Design and Sample

The study relies on the survey method. This method was also used by other researchers in this field, for example, Ryu and Han (2018). The survey method stands as one of the most prevalent approaches in sociological and psychological research endeavours, employed for the acquisition of qualitative data. This methodology affords researchers the capability to elicit profound and intricate responses from participants, thereby facilitating the acquisition of in-depth insights.

Survey

The study involved 375 teachers from Russia and China. There were teachers from Yelabuga Institute of Kazan Federal University (75 people), Kuban State Technological University (65 people), the School of Internet of Things Technology in China (53 people), and Russian and Chinese General

Education Schools (100 and 82 people, respectively). The teachers are 26-54 years old, and their work experience ranges between 1-25 years.

The study involved teachers from Russia and China (Table 1):

The leaflets describing the procedure and objectives of the study were handed out to research participants in their educational institutions. Those wishing to participate gave their e-mail addresses to be sent a questionnaire. The questionnaires were sent out on August 5, 2021, and the deadline for filling them out was August 10, 2021.

The questionnaire contained 11 questions; there were 10 closed-ended questions and one (No. 11) open-ended.

Questionnaire questions:

(1). Do you use modern technologies in the teaching process (gadgets, electronic boards, computers, etc.? (Yes / No)
(2). Are you familiar with the concept of "artificial intelligence"? (Yes / No)
(3). Do you think that artificial intelligence can be introduced in education on a large scale in the coming years? (Yes / No)
(4). Have you faced the use of any form of artificial intelligence in your educational institution? (Yes / No)
(5). In your opinion, would it be feasible to use artificial intelligence in teacher training? (Yes / No)
(6). Can the use of artificial intelligence improve the quality of teacher training? (Yes / No)
(7). Can the use of artificial intelligence decrease the quality of teacher training? (Yes / No)
(8). Can teacher training be based exclusively on artificial intelligence? (Yes / No)
(9). Have you ever encountered the use of artificial intelligence in other areas? (Yes / No)
(10). Do you think the use of artificial intelligence is effective in other areas? (Yes / No)
(11). Describe your opinion on the use of artificial intelligence in teacher training. Please comment on your answers to the above questions, if needed.

Data Analysis and Statistical Processing

The questionnaire was compiled in Google Docs. The completed questionnaires were later analyzed.

The analysis of open-ended questions was conducted through the process of categorization and encoding of responses. After the establishment of categories, responses were encoded by these

Table 1. Demographic information

Gender	Male	173
	Female	202
Age	26-35	153
	36-45	128
	46-54	94
Country	Russia	240
	China	135
University / School	Kazan Federal University	75
	Kuban State Technological University	65
	School of Internet of Things Technology (China)	53
	Russian schools	100
	Chinese Schools	82

categories utilizing text analysis software. For response analysis through coding, distinct categories were delineated, which may manifest within the responses as follows: 1 - Positive Attitude towards Artificial Intelligence (AI), 2 - Cautious Approach to AI, 3 - Self-Educational Utilization of AI, 4 - Integration of AI in Education and its Advantages, 5 - Incremental Integration of AI in Education, 6 - Application of AI to Aid Pedagogical Preparation, 7 - Preservation of Critical Thinking Skills.

Ethical Issues

Before completing the questionnaire, the respondents had to read and accept the terms and conditions of the study.

Research Limitations

The study is reliable as the respondents' answers are available in electronic format; however, it should be noted that it was conducted only in Russia and China and the number of participants was limited.

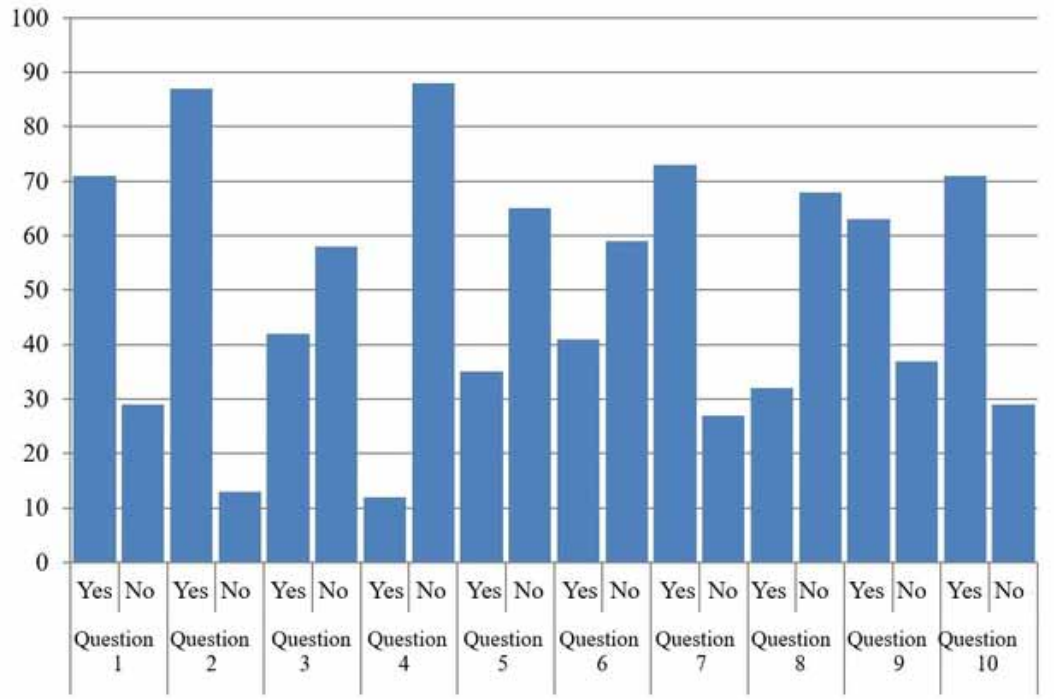
RESULTS AND DISCUSSION

The participants' responses were as follows (Figure 1):

1. Do you use modern technologies in the teaching process (gadgets, electronic board, computers, etc.? (Yes / No)

According to the results obtained, 71% of respondents use modern technologies in their teaching activities while 29% do not. Thus, it can be concluded that most participants have experience in using modern technologies in the teaching process. One of the reasons for this phenomenon is the Covid-19

Figure 1. Results of the analysis of teachers' answers to questions 1-10, %



pandemic, which in 2020 forced several educational institutions around the world to switch to distance learning. Before this, technology was also used by educators and students, but to a lesser extent.

2. Are you familiar with the concept of "artificial intelligence"? (Yes / No)

Thus, 87% of respondents noted that they were familiar with the concept while 13% knew nothing about it. Even though artificial intelligence is not yet popular, most respondents are aware of its existence. It is necessary to raise the awareness of teachers in the field of IT and artificial intelligence (training, self-education, motivation).

3. Do you think that artificial intelligence can be introduced in education on a large scale in the coming years? (Yes / No)

There were 42% of respondents answered in the affirmative and 58% replied in the negative. Even though today digital technologies are rapidly developing, the majority of respondents still believe that there will not be a large-scale introduction of artificial intelligence in the field of education shortly. There may be various reasons for this, for example, the lack of efficiency and poor operation of many tools (Google Translate, Siri, etc.), as well as the lack of experience in their application.

4. Have you faced the use of any form of artificial intelligence in your educational institution? (Yes / No)

According to the results, 12% of respondents have faced the use of artificial intelligence in their educational institution while 88% have not. This suggests that today artificial intelligence is hardly used in educational institutions. To ensure a more extensive use of artificial intelligence, there is a need for a more thorough development of tools, and, subsequently, the allocation of budgets for the implementation of such technologies in educational institutions.

5. In your opinion, would it be feasible to use artificial intelligence in teacher training? (Yes / No)

Thus, 35% of respondents noted the feasibility of using artificial intelligence in teacher training while 65% had the opposite opinion. This result is most likely due to the respondents' narrow understanding of the essence and capabilities of artificial intelligence, as well as little experience in its application. To increase the acceptance of artificial intelligence, it is necessary to provide an opportunity to use it and evaluate its positive aspects.

6. Can the use of artificial intelligence improve the quality of teacher training? (Yes / No)

This question showed that 41% of respondents think that artificial intelligence can improve the quality of teacher training while 59% disagreed with the statement. As can be seen, slightly fewer than half of the respondents believe that artificial intelligence can improve the knowledge of rising teachers. Even though teachers have little experience in using artificial intelligence, their attitude towards it is still quite positive.

7. Can the use of artificial intelligence decrease the quality of teacher training? (Yes / No)

According to 73% of respondents, artificial intelligence can decrease the quality of teacher training; 27% in contrast believe that it can improve the quality of teacher education. Most respondents

assume that the use of artificial intelligence can negatively affect the knowledge of rising teachers. This is probably due to their negative distance learning experience in 2020-2021 and the lack of understanding of what artificial intelligence is. This problem can be solved in the process of the wider application of artificial intelligence.

8. Can teacher training be based exclusively on artificial intelligence? (Yes / No)

Thus, 32% of respondents replied in the affirmative while 68% answered in the negative. As can be seen, most research participants believe that it is impossible to rely exclusively on artificial intelligence in teacher education. At the moment, this is justified; the use of technology is often combined with traditional training. However, the use of artificial intelligence in education can be increased in proportion to improvements in its quality and application experience.

9. Have you ever encountered the use of artificial intelligence in other areas? (Yes / No)

There 63% of respondents have already encountered the use of artificial intelligence in other areas and 37% of respondents have not. The fairly extensive application of artificial intelligence in other areas suggests that it can be effectively implemented in the field of education. It shows that artificial intelligence can simplify and optimize several processes better and faster than humans. In addition, new technologies will help teachers save time, which they can devote to communication with students and self-education.

10. Do you think the use of artificial intelligence is effective in other areas? (Yes / No)

According to 71% of respondents, the use of artificial intelligence is effective in other areas; 29% of participants have the opposite opinion. As the majority of respondents consider the use of artificial intelligence in other areas to be effective, there is reason to believe that its use in education will not be criticized or rejected by teachers and students. A positive experience is significantly important when introducing this technology into a new field.

Examples of teachers' answers to question No. 11 (Describe your opinion on the use of artificial intelligence in teacher training. Please comment on your answers to the above questions, if needed):

Respondent 1 (Russia): I do not have enough experience and knowledge in the field of artificial intelligence. As far as I understand, it is not yet widely used in Russia. In my opinion, it should not be introduced into the field of education abruptly and quickly. First, there is a need to consider all the pros and cons, which should be followed by the gradual introduction of the technology while carefully observing students' performance.

Respondent 2 (Russia): I have a positive attitude towards modern technologies. Artificial intelligence can and should be implemented in various areas, including training. At the same time, I think that it is more appropriate to use it for self-education, for example, for learning foreign languages or the basics of programming. An educator is a professional who must be able to communicate with people; therefore, we cannot rely exclusively on artificial intelligence.

Respondent 3 (China): Today, in the era of high technology, the use of artificial intelligence should be a fact of our life. It can be applied in various fields (commerce, government agencies, education). Artificial intelligence empowers people and saves human labour. I think that it is advisable to use it in teacher training.

Respondent 4 (Russia): Artificial intelligence can be partly used in teacher education. These can be various functions of search engines (such as Google), electronic translators, applications for calculations, etc. However, it is necessary to ensure that rising educators have a responsible attitude to these types of assistance and do not lose the skills of critical (and other types of) thinking.

Following the encoding of responses, the frequency of each category was tabulated, resulting in Table 2. This table elucidates the percentage distribution of responses across each category. Hence, a thorough understanding of respondents' dispositions toward artificial intelligence and their viewpoints concerning its incorporation into the educational process has been achieved.

The results of question No. 11 show that teachers' attitude to artificial intelligence is generally positive provided that it is reasonably applied taking into account the specifics of certain objectives. Most respondents believe that there is no need to switch abruptly to the use of artificial intelligence in teacher training. It can be gradually implemented and student results should be constantly monitored.

Most respondents believe that artificial intelligence should be used in combination with the traditional approach to learning. Among the participants there were also adherents of exclusively traditional (22%) and exclusively new technologies (11%) (Figure 2).

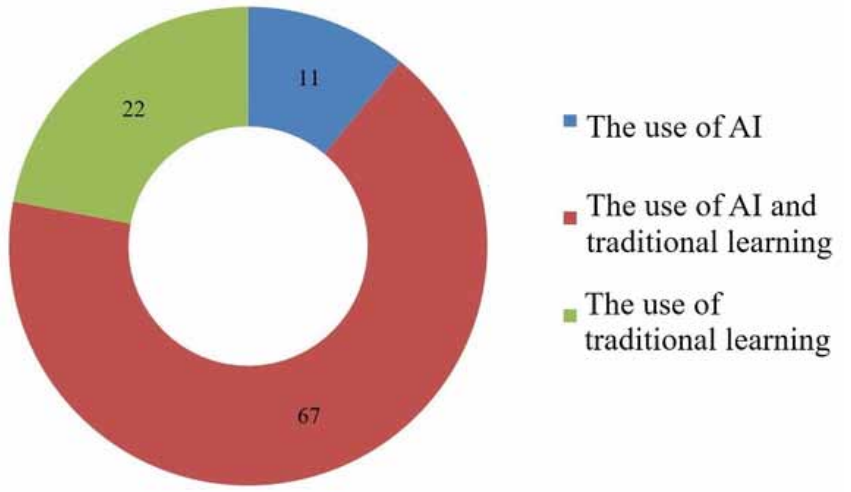
AI Acceptance

As can be seen from the respondents' answers, the acceptance of artificial intelligence today is at a low level; 65% of respondents believe that it is not feasible to use it for teaching students. At the same time, many of them do not have enough experience in the use of digital technologies in education, which suggests that their opinion is mainly due to their negative attitudes and prejudices.

Table 2. Statistical analysis of open-ended inquiries

Category	Number of responses, percentage %	SD
Positive Attitude toward AI	60	0.25
Cautious Approach to AI	20	0.10
Utilization of AI for Self-Education	20	0.08
Application of AI in Education and its Advantages	40	0.12
Gradual Integration of AI in Education	40	0.10
Application of AI to Aid in Pedagogical Preparation	20	0.06
Preservation of Critical Thinking Skills	40	0.11

Figure 2. Respondents' preferences for learning approaches



Critical Thinking and the Use of Artificial Intelligence

Today, some people believe that artificial intelligence has a positive effect on critical thinking while others have an opposite opinion. Thus, 41% of the research participants think that artificial intelligence can improve student performance and 73% are sure that it will make it worse. Probably, in order for artificial intelligence to positively influence critical thinking, it is necessary to competently develop the corresponding systems and properly implement them in educational institutions taking into account the age, level of knowledge, needs and other characteristics of students.

Teachers' Working Hours and the Use of Artificial Intelligence

In the study, 68% of participants reported that artificial intelligence helps them complete routine and administrative tasks faster, and therefore devote more time to communication with students. Further improvement of artificial intelligence in the field of education will make it possible to delegate even more complex functions of teachers to computers. This will save teachers' time and allow them to focus on more important things (students, self-education, family).

Based on the results of the study, the scheme for the artificial intelligence introduction into teacher training can be recommended (Table 3).

In general, the transition to the full use of artificial intelligence takes 4-8 years. At the same time, it is necessary to thoroughly monitor students' knowledge after each stage (exams, tests). Additional knowledge checks should be conducted every 2-3 months in order to avoid significant gaps in students' knowledge. This can be done either with the help of online tests or written/oral exams administered by teachers. The curriculum must be developed (or adapted) in accordance with the needs of a particular educational institution.

The research participants noted that the use of artificial intelligence can reduce the waste of teachers' time on low-priority functions and save time to allow them to focus on more important tasks. According to other researchers (Bryant et al., 2020), from 20 to 40% of teachers' working hours are spent on activities that could be automated. In this regard, it will be possible to redirect about 13 hours per week to improve student performance and ensure greater satisfaction of teachers with their work. Despite the fact that student knowledge is improving as a result of technology-driven personalized blended learning, these improvements have yet to be fully realized. The 13 hours saved will enable teachers to devote themselves to their families, social and emotional learning, the development of 21st-century skills, and collaboration with other teachers (Bryant et al., 2020).

The results of the research show that today some teachers are a bit sceptical about the use of artificial intelligence in teacher education. Despite this, many scientists are optimistic (Nichols & Holmes, 2018). Some researchers advocate for a future classroom with independent robot teachers highlighting the minimum requirements for the job in terms of teacher personality, teaching, social interaction, and influence (Edwards & Cheok, 2018). A good teacher is expected to be sociable, active, and involved as indicated by several characteristics, including the following: (1) physical

Table 3. Stages of the transition to the use of artificial intelligence in teacher training

	Stage	Duration
1	Gradual inclusion of artificial intelligence in the curriculum (5-20% of the time) in order to explain new material, check student assignments, and provide feedback	1-3 years
2	Increase in the use of artificial intelligence in the curriculum (20-45%) at the expense of the teacher time reduction	1-2 years
3	Allocating more than half of the time (45-70%) to work with artificial intelligence. In case of poor results, it is necessary to revise the curriculum	1-2 years
4	Transition to the full use of artificial intelligence (up to 100%)	1 year

appearance or presence, including the ability to interact with other agents face to face; (2) distribution of attention to other agents and vice versa: mutual understanding of messages; (3) believable verbal and non-verbal behaviour, the use of symbolic expressions, the ability to recognize another agent(s) and perceive oneself as recognized; (4) adherence to the rules of social communication (sequence, greetings, forms of address, farewell, social signals (proxemics, look, etc.); (5) modelling social roles associated with the context; (6) synchronized and coordinated context-dependent actions/behaviour; (7) social memory (Edwards & Cheok, 2018). Robot teachers have not been extensively used so far; nevertheless, a number of experts believe that this is a good prospect: a robot can work around the clock, teach different subjects, and explain the material several times; it is never late and does not complain (Ivanov, 2016).

Similarly, other scientists also note a correlation between the attitudes towards artificial intelligence and the gender of the respondents. In our study, the perception of AI by female teachers was worse than that of male teachers. Teachers with the experience of working in leading schools recognized that training based on AI will contribute to students' creativity. Teachers with extensive teaching experience have a strong interest in artificial intelligence and understand the relevance of the issue (Ryu & Han, 2018). The present study has shown that younger teachers are more positive about artificial intelligence than older ones.

Today teachers often lack the knowledge to evaluate the effectiveness of modern technologies or to apply them in educational institutions (Karsenti, 2019). This has also been confirmed in the present study. In Russia, there is a need to train teachers to work in an electronic information-educational environment (EIEE), which is constantly and intensively enriched with artificial intelligence technologies. The solution to this problem requires the development of new science-based curricula of academic disciplines that focus on training teachers to use technologies and artificial intelligence in their professional activities; it is also necessary to confirm the effectiveness of the programs by testing them in pedagogical universities in Russia (Vlasova et al., 2019).

At the initial stages, artificial intelligence can be delegated certain responsibilities (administrative tasks, checking student assignments, reporting) as today the performance of robot teachers is not as good as that of humans. The four key educational processes that can be influenced by artificial intelligence are content, teaching methods, assessment, and communication (Chassignol et al., 2018). Robots can tailor content to meet students' needs. Traditional teaching methods can be supplemented with improved visualization of information, the use of games, virtual reality, etc. In addition, robots can check students' assignments and evaluate them, as well as give feedback, if needed, and notify parents. Thus, artificial intelligence can be more extensively introduced into the educational process provided that positive results are obtained.

Considering all the pros and cons of using artificial intelligence in teacher training, it can be concluded that its application is associated with a good perspective as according to most people, the number of advantages exceeds the number of disadvantages. The advantages of using online learning and artificial intelligence are as follows: a more advanced concept of learning; a wide range of learning methods; an opportunity for teachers to exchange experience; a wide variety of teaching methods; more control over the learning process; improved learning efficiency (Williamson, 2020).

A survey of teachers from the Netherlands showed that there are problems in the following areas: privacy and security, psychological well-being, applicability, human contact, trust, etc. (Van Ewijk et al., 2020). A study in Greece found that student responses to a robot teacher in the classroom were positive. This is of current interest in the context of the Covid-19 pandemic as human-to-human contact decreases (Velentza et al., 2020).

Researchers from Hong Kong have studied the use of an avatar teacher in foreign language learning and have obtained positive results (the robot does not punish students, and the robot can change the curriculum in accordance with the needs of students); they recommend using technology for motivational purposes and involving students with the help of useful and valuable content (Kwok, 2015).

British scientists have developed a low-cost mobile robot platform Colias that will be of particular assistance in developing countries. The cost of this robot can be reduced by removing some hardware from it, which will not interfere with its use (Gyebi et al., 2015).

CONCLUSION

Today, the familiarity of teachers with modern teaching technologies and artificial intelligence is rather low despite the fact that 71% of the respondents participating in the study use modern technologies one way or another in the process of teaching. Artificial intelligence tools are partly used (for example, search engines) to solve specific problems. A complete transition to teaching exclusively based on artificial intelligence is not yet possible today, but 32% of respondents believe that AI can be used in teacher training. Also, 35% of respondents note that artificial intelligence can be partly introduced in teacher training as teachers must have a number of qualities that cannot be developed without live interaction with people.

Today, many people are sceptical about the use of new technologies in education, in particular artificial intelligence. Thus, only 41% of respondents believe that the use of AI can improve the knowledge of rising teachers and 73% think that their knowledge may deteriorate. This is probably due to the lack of experience in the application of such technologies in educational institutions and the lack of understanding of their possible impact on students' knowledge.

The respondents' answers reveal a number of problems associated with the introduction of digital technologies in educational institutions (lack of facilities and hardware, slow Internet connection). At the same time, the main problem is the lack of teachers' knowledge and skills in using modern teaching tools. In order to improve this knowledge, and thereby facilitate the acceptance of artificial intelligence, it is necessary to teach students the basics of using such technologies during their studies at universities/colleges. This will considerably reduce fear and prejudice when using artificial intelligence in the future.

Today digital technologies and artificial intelligence can help teachers in a few areas (for example, planning, content optimization, student assessment, administrative tasks, etc.). Our respondents note the positive impact of such assistance on their work and an opportunity to save a great amount of time that can be devoted to more important things (self-education, direct interaction with students, etc.). Also, the use of technology allows educators to make the learning process more interesting and exciting, which, in turn, increases the motivation of students to learn.

The results of the study showed that the level of acceptance of artificial intelligence in education is rather low today. This is mainly due to the lack of experience in its application. Thus, only 27% of respondents believe that artificial intelligence will not have a negative effect on students' knowledge and critical thinking. To better understand the effect of artificial intelligence on thinking, it is necessary to have some experience in its application; 68% of respondents appreciate the help of artificial intelligence with routine and administrative tasks.

Based on the results of the study, the transition to the full use of artificial intelligence will take 4-8 years. The transition involves 4 stages: the gradual incorporation of artificial intelligence into the curriculum (5-20% of the time); an increase in the use of artificial intelligence in the curriculum (20-45%); allocating more than half of the time (45-70%) to work with artificial intelligence; transition to full use of artificial intelligence (up to 100%). It is recommended to monitor the quality of students' knowledge after each stage of implementation using exams, tests, etc.

The research is a contribution to the study of the psychological and pedagogical aspects of the introduction of new technologies and artificial intelligence in the field of education and will be of interest to teachers, students, parents, school and university administrations, as well as to a wide range of people interested in modern education trends. The information will help mitigate problems that may arise in the process of using artificial intelligence (as they are known in advance), identify and use its strengths, as well as create an optimal curriculum based on such technologies.

Despite the valuable insights garnered from this study, several domains necessitate further examination and exploration. Prospective inquiries into the realm of artificial intelligence in education may centre on the following aspects:

- Longitudinal Studies: Conducting longitudinal investigations over extended durations could yield a more profound comprehension of the enduring impact of artificial intelligence integration within education.
- Comparative Studies: Undertaking comparative inquiries across diverse educational institutions and countries could provide valuable insights into cultural and regional factors that influence the adoption and integration of artificial intelligence in education.
- Teacher Preparation Programs: An investigation into the structure and efficacy of teacher preparation programs oriented towards the integration of modern teaching technologies, including artificial intelligence, holds paramount significance.
- Student Learning Outcomes: It is of utmost importance to investigate the influence of artificial intelligence on students' learning outcomes, their engagement, and academic attainment.

Future research endeavours within the realm of artificial intelligence in education hold the promise of addressing challenges and optimizing the benefits of integrating AI technologies into teaching and learning processes. By scrutinizing the presented facets, researchers and educators can pave a pathway towards a more informed and efficacious implementation of AI, ultimately augmenting the quality of education and preparing learners for a technological future.

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Authors declare that they have no conflict of interest.

DATA AVAILABILITY

All data generated or analysed during this study are included in this published article.

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