# Exploring AI-powered personalized learning in universities

**Olga Agatova[1], Liliya Latipova[2]**
[1]Department of Psychology and Pedagogy, Faculty of Philology, Peoples Friendship University named after Patrice Lumumba, Moscow, Russian Federation
[2]Department of Engineering and Technology, Kazan (Volga Region) Federal University, Yelabuga, Russian Federation

| Article Info | ABSTRACT |
|---|---|
| | The study examines the problem of implementing and developing personalized learning with the help of artificial intelligence (AI) tools in universities. To solve this problem, the following goals were set: identifying the opportunities for personalized learning based on learning tools powered by AI according to university teachers; examining the current state of AI-powered learning technologies using the example of two developing countries; and clarifying the existing challenges and prospects. The study uses a survey and an interview. The results indicate that 82% of the respondents were generally aware of AI and personalized learning. The findings show that 89% of the teachers disagreed with the idea that AI and personalized learning have the potential to replace traditional educational strategies. The teachers identified several challenges, such as the lack of personal communication and difficulties with recognizing emotions, in the proposed strategies. Thus, 43% of the respondents suggested integrating AI into the educational process as a supplement to the traditional teaching methods. The analysis of interviews revealed that 85% of the teachers were positive about the implementation of AI and personalized learning in universities. Nevertheless, educators report that AI-generated tools are still underdeveloped and cannot replace all functions of teachers. |
| | |

*Corresponding Author:*

Olga Agatova
Department of Psychology and Pedagogy, Faculty of Philology
Peoples Friendship University named after Patrice Lumumba
Miklukho-Maklaya str. 6, Moscow, 117198 Russian Federation
Email: o_agatova@gmx.com

## 1. INTRODUCTION

The development of digital technologies has flourished and grown exponentially throughout the last decades. Technological changes have influenced public life and education. The COVID-19 pandemic has posed new threats to education and forced many educational institutions to switch online. The transition to distance learning has created challenges for both teachers and students. Due to new social and economic conditions, educators have become introduce technological solutions in the traditional classrooms, including artificial intelligence (AI) and personalized learning. Educational technologies are perceived as both risks and opportunities for distance learning [1].

The challenges of the COVID-19 global pandemic have readjusted the educational process. The concept of distance learning had emerged before the pandemic. However, pandemic restrictions have forced educators and parents to adapt to the updated context of education. Many educational institutions did not have the technological tools to establish a new learning environment. After one and a half years, many educators have managed to implement distance learning in traditional classrooms and identified the disadvantages and advantages of online learning. The role of AI in education (AIED) has increased and the

research in this field has identified the current problems and optimized the learning process. Personalized learning helps every student reach their full potential and improve academic achievements. It also allows individuals to effectively broaden their knowledge, improve their skills, and receive on-the-job training.

The modern system of education is influenced greatly by the economic challenges and the increasing demands of employers. AI plays a pivotal role in Education 4.0. The new approach to education helps teachers evaluate student motivation and weaknesses, as well as customize personalized student learning paths based on knowledge, adaptive learning systems, and AI [2]. The intersection of AI and personalized learning in education opens up wide opportunities for improving the educational process and ensuring effective student development [3], [4]. This field of research and practice combines advanced data analysis and intelligent interaction technologies with each student's individual needs and learning styles. Given the relationship between distance learning and AI, intelligence reproduction technologies play an important role in improving the effectiveness of distance learning. Thus, AI systems can adapt learning to the individual needs of each student, providing a personalized learning approach based on pace, style, and level of assimilation of the material. The personalization of the educational process, in turn, becomes especially important in distance learning, where each student learns remotely. Remote platforms can use AI to automatically tailor educational content to the needs of each student.

AI means the ability of software to perform usual inherent humans' tasks (perception, learning, and problem-solving) [2], [3], [5]. The advantages of AI in education are significant. AIED has undergone major changes throughout the past quarter century [6]. AIED implies using algorithms and technologies that can perform tasks that previously required human intelligence to improve learning processes and outcomes [7]. AI can create customized curricula tailored to each student's personal interests, abilities, and learning pace. For example, adaptive learning systems adjust the complexity of tasks according to the results of previous tests, offering an optimal learning environment for each student. Chatbots and virtual assistants that provide instant assistance and real-time support to students, answer questions, and explain complex concepts [8]. The capabilities of AI cover the automatic assessment of tasks and assignments, which involves detailed analysis of the results and recommendations for improvement. This feature allows teachers to focus on the more complex aspects of learning, leaving routine tasks to the machine. AI helps create dynamic and interactive courses that are available for a large audience around the world, providing quality education regardless of geographical location [7], [8]. In general, the introduction of AIED increases the efficiency of educational processes, enhances student outcomes, and creates an inclusive and accessible educational environment.

Personalized learning is an approach in education that involves customizing the learning process for each student's needs, strengths, skills, and interests [5]. Personalized learning through AI has not yet been sufficiently advanced, but it is a priority for modern educators. The smart learning environment (SLE) incorporates adaptive learning and personalized learning as integral parts. The SLE provides space and activities to facilitate effective learning. The scholars admit that personalized adaptive learning is based on four pillars: the learner profile, competency-based progress, personal learning, and a flexible learning environment [9].

Personalized learning has three important characteristics: i) the learning processes focuses on the student with their unique individual strengths, interests, and needs; ii) the type, process, time, and place of learning are flexible parameters; and iii) it helps students to control the process [4]. In a personalized learning environment, students are active agents of learning. Under such conditions, students are stakeholders of the process and are involved in the design of the learning program. In this case, the educator acts as a facilitator in the personal learning journey. Personalized learning can be developed for one student, for small student groups based on certain parameters, or for large student groups based on more general parameters [10].

The basic problems that need to be studied are that the actual implementation of AI and the personalization of learning. These challenges require specific conditions and significant changes in both the logistics of pedagogical processes, as well as in staff training. There is a need to update the whole discourse of educational programs [11], [12]. Adaptive learning seems to be one that may no longer require the presence of a human teacher, which dramatically alters learning processes [13], [14]. How deep this process is and how to make the processes of implementing AI in education effective remains a set of difficult questions. In practice, the implementation of AI often gives controversial results. It is necessary to understand why this is the case through communication with teachers [8], [9].

AI-powered personalized learning is an area of information technology. Its successful development and implementation can optimize the educational process and adjust it to modern standards. For example, AI can adapt learning tasks and materials to the individual needs and level of knowledge of each student. In personalized learning, AI systems can analyze the results of students and provide personalized recommendations for optimal learning [2], [5], [10]. Intelligent systems can also monitor student progress, analyze their responses and learning progress, and offer teachers detailed data on each student [10]. AI can serve as a tool that automatically evaluates student performance and feedback. This feature reduces the burden on teachers and allows them to focus on providing quality instruction and constructive feedback [6], [11].

AI systems can also outline adaptive learning trajectories and use virtual resources to create classes that optimally meet the diverse needs of students. This intersection of technologies in education not only diversifies learning approaches but also opens up ways to improve access to quality education and develop individual learning paths.

This research aims to analyze the responses of university professors teaching in Russian and Kazakhstan educational institutions regarding personalized education in universities. They can identify current problems, disadvantages, opportunities and AI effectiveness for the educational process. The research objectives are: to study university teachers' view on the opportunities for personalized learning powered by AI; to examine the current state of AI-powered learning technologies using on the example of two developing countries; and to clarify the existing problems and future prospects.

## 2. LITERATURE REVIEW
### 2.1. History and types of modern learning technologies
The origins of the modern learning process can be traced back to the class-lesson system developed by Comenius. Technology development has transformed education and caused four changes: e-learning, m-learning, u-learning (ubiquitous learning), and s-learning (smart learning). The highest level of e-learning is smart learning. SLE rests on two different types of methodologies: smart device (the internet of things, wearable devices) and smart technology (learning analysis, individualization on the base of AI, and cloud computing). The second type is more effective, adaptable, inspiring, and responsive [9].

From the cognitive theory's perspective, the learning process involves the mental processing of information (constructing, acquiring, organizing, encoding, repeating, memory storing, and retrieving). The ability to learn is a cognitive skill that allows individuals to process information related to a wide range of topics. Different psychological and learning theories underline that the learning process and knowledge acquisition is a personal experience. In recent years, personalization of learning has been integrated in education with the help of different methods based on information and communication technologies [15].

Microsoft partner learning research has identified six critical elements considered key features of 21st-century education. One of these features is the educational implementation of ICT. The other five features include educational collaboration, system knowledge building, students' self-regulation, reliance on real-world problem solving, widespread of innovations, and effective communication [16].

### 2.2. Artificial intelligence in education
Artificial intelligence has altered education and transformed the traditional classroom. Nevertheless, innovative approaches cannot replace traditional education and social interaction. AI-powered tools, such as gamification, virtual reality (VR) and augmented reality (AR), can supplement traditional techniques. The introduction of AI allows for the improvement of massive open online courses (MOOCs). The evaluation of learning assignments and identification of gaps in teaching and knowledge acquisition will no longer be a problem. However, smart scoring systems may miss some correct answers, because the AI-powered system makes decisions based on mass statistics only. The assessment systems powered by AI cannot be successfully applied to all assignments without human involvement. Another important aspect is that smart teaching systems can register a digital student profile and assign each student a personal instructor to increase learning productivity in the classroom and outside. A digital portfolio of disciplines mastered by students can help employers in their decisions to employ an individual. Personal learning environments (PLEs) help students with disabilities of all ages, including individuals with health-related disorders, receive more effective learning [17]. AI-powered technologies can help educators to introduce new approaches in pedagogy including strategies such as collaborative learning [8].

Views on the use of AI in education are predominantly based on cognitive or constructivist approaches, which see the personalization of learning as the dominant path for the development of education [12]. Interaction with AI expands the richness of behavioral patterns of education participants in their cognitive activity. This requires the adequate implementation of AI elements in the educational process and the readiness of both students and teachers to interact with this technology [1], [18].

### 2.3. Personalized learning in modern education
In personalized learning, it is important to take into account the individual learning styles of students in order to create a successful learning program. Correct identification of a learning style is one of the steps to adapting e-learning or traditional learning to unique learners' needs and expectations [11]. Many technologies powered by AI integrate adaptive educational systems, such as decision trees, fuzzy logic, neural networks, genetic algorithms, Bayesian networks, and hidden Markov models. Nevertheless, there is no standard approach, which would help to identify the most appropriate learning theory and the most

reliable AI method to integrate into the learning environment. It is important to develop tools that make it easier to identify the learning style from the student behavior profile [11].

Educational institutions in developing countries are actively using personalized learning. In turn, AI-powered technologies were designed in developed countries. It is explained by a lack of resources and availability of ICT in developing countries [18]. The role and importance of AI in e-learning (AIeL) has increased because of the use of technology in different fields of education, such as medical education, language learning, science courses, mathematics, and general disciplines. Different AI-generated technologies have been widely adopted by educational institutions, including personalized e-learning environments, smart detection of learning styles, and task-based adaptive learning [19].

Personal learning environments are key issues of modern education. PLE helps students to access an environment that combines a network of humans, educational resources, learning and electronic services. PLE plays a pivotal role in improving learning and teaching. Students become responsible for the learning process. PLE possesses several characteristics: it involves students in the educational process, develops a sense of responsibility; ensures autonomy to students; enhances knowledge; reveals relationships with real-world; provides a platform for communication and information exchange; develops critical thinking and creative abilities; promotes mutual respect among students and teachers [20].

The personalization parameters are: i) an information search task; ii) the student's level of knowledge; iii) learning objectives; iv) preferred media; v) language preferences; vi) the participant's balance; vii) progress; viii) waiting on feedback; ix) level of motivation; x) navigation preferences; xi) characteristics of cognitive activity; and xii) a pedagogical approach [21]. Adaptive learning theory involves the use of technology based on the unique needs of each student with educational resources. A PLEs means personal e-learning spaces traditionally based on two components, namely a personal learning network and a personal learning portfolio [22].

Personalized adaptive learning is a technology-powered, effective pedagogical approach that tailors teaching strategies to the individual needs, academic expectations, and personal development of each student. The scholars admit that a personalized learning approach consists of the following components: student profiles, previous knowledge and experience, personalized adaptive learning paths, and flexible environments for self-learning created using analytics [23]. This approach aims to enhance student engagement and outcomes by ensuring that the educational content and methods are suitable for each learner's unique context and progress.

## 2.4. Personalized learning powered by artificial intelligence

Personalized learning powered by AI can be successfully introduced in educational institutions and commercial organizations to train and improve the skills of employees. This training can include the following strategies: analysis of employee performance based on preset parameters; identification of training needs; identification of the employee's preferred method and style of learning; identification of the trainer's teaching approach: teaching style, personal characteristics, knowledge, experience and selection of trainers for students. It also includes clarification of time limits, frequency, speed, and mode of learning; assisting in knowledge management within the organization; reducing the human factor; assessing student personal development; as well as developing a training schedule [24].

### 2.4.1. Virtual reality

Virtual reality is a term first applied in the 1960s to define different progressive technologies, including software and hardware designed to simulate the real world. Chronologically, variants of this technology include Sensorama simulator, online gamified virtual worlds, massively multiplayer online role-playing games, surgical simulators, full range environmental display rooms, and head-mounted displays. Scholars from Denmark described different scenarios for incorporating head-mounted displays. They identified three main areas that can benefit from using these devices: cognitive skills related to the storage and comprehension of visual and spatial data processing and knowledge acquisition; psychomotor skills, including head movements, visual perception, and observation; and effective coping skills for dealing with emotional responses to difficult stressful situations [25].

### 2.4.2. Human emotion recognition

Humans have intelligence, but they also have emotions. Emotional responses are an important topic for the research that examines how individuals react to different situations. Emotions are also an essential component of human decision-making and reasoning. Scholars should consider these facts when modelling human reactions, especially when these reactions influence the behavior patterns of other individuals, for example, in workgroups, training sessions, education, and so forth [14].

Data mining and machine learning have great potential for education. The use of online learning models is a vital part of building personalized learning systems [26]–[28]. Data clustering is a method of dividing objects into groups according to the principle of homogeneity and similarity of objects in each group [29]. In the academic context, big data is used to improve educational achievements (academic analytics, educational analytics, and educational data mining) [13]. In recent years, academic literature has discussed successful cases of applying AI-powered tools in education. The authors from the USA discuss the role of learning with personalized tools in the development of an electronic adaptive tutor for reading comprehension-interactive strategy training for active reading and thinking (iSTART). The system provides adaptive, interactive, and game-oriented teaching to improve text comprehension by teenagers) [30].

The analysis of literature reveals that there is research on the parameters and opportunities proposed by AI-generated tools that support personalized learning for students. Given successful examples of the use of AI for personalized learning, this technology has the potential to be the tool of the future pedagogy. Nevertheless, there is less research on the experience of teachers and students using AI-powered technology in education. The real experience of its application, especially in developing countries, is complicated [1], [8], [31]. The set of problems faced by teachers and students requires consideration and includes technological and financial limitations, psychological adaptation to new technology, and identifying natural limitations inherent in AI through practical experience. To increase the effectiveness of AI as a tool for personalized university learning, it is necessary to study this experience and the problems.

The scope of the study focuses on the opinions and attitudes of teachers towards AI-powered learning technologies. Teachers implement AI technologies and unwittingly act as their promoters. In real life they often face the challenges and imperfections of these technologies in the educational system. The study of their opinion is a significant gap in academic research. Teachers' perspectives can provide valuable insights into the practical implications and potential improvements needed for successful integration of AI in education.

## 3. METHOD

### 3.1. Research design and sample

Data collection methods include questionnaires and interview analysis. The sample involved 78 teachers from two universities in the Russian Federation and Kazakhstan as shown in Table 1. A selection of participants rested on a random sample. The study participants were randomly selected from a list of teachers working at both universities included in the study. Random sampling was chosen because it allows each element in the group to have an equal opportunity to be included in the study. As a result, this selection method ensures that the sample is more consistent with the general population. With the help of a random number generator, every third teacher from the list of teachers from both universities was selected. The selected individuals were contacted by the researchers via e-mail with an invitation to participate in the study. Ultimately, 78 participants provided consent. This approach contributes to the objectivity and representativeness of the sample since teachers were randomly selected from the entire group [32].

Table 1. Demographic characteristics of the sample

| Variable | Value | The number of participants |
|---|---|---|
| Age | 26-35 | 27 |
| | 36-45 | 29 |
| | 46-58 | 22 |
| Gender | Female | 43 |
| | Male | 35 |
| University | University 1 | 38 |
| | University 2 | 40 |

This approach is due to the fact that teachers have different experiences with digital technologies and different access to digital tools within their courses and opportunities of universities, in particular, to the elements of AI technology. The ratio of the sample size to the general population of teachers from both universities indicates a possible sampling error of up to 4.81. Therefore, it is reasonable to consider the sample as representative in this case. Thus, the findings provide a reliable overview of the current state and potential of AI-based personalized learning in higher education institutions.

In one day, the teachers filled out a questionnaire distributed at the request of the research instructors (Oct, 11th 2021) and were interviewed. The research took place in special classrooms at both universities. The administration of the universities invited teachers to participate in the research. The participants received the questionnaire via email and completed it in the classroom using computers. The

interviews were also conducted in the classroom, in a face-to-face environment: participant-interviewer. Each interview lasted 20 minutes and was recorded using a voice recorder. The response data was analyzed using Microsoft Excel.

The research was conducted ethically in accordance with the World Medical Association Declaration of Helsinki. The research was approved by the local ethics committee of The Peoples Friendship University named after Patrice Lumumba. Each participant received information on the research objectives and procedures in a printed form. All participants signed written consent for participation in the research.

The purpose of the survey was to obtain primary data on the teachers' opinions and assessments regarding AI-based technologies. This data allowed for the formation of the recommendations presented in the article. The 3-question interview provides an opportunity to get a detailed answer beyond the binary assessment (yes/no) used in the questionnaire. This type of interview can reveal the views of teachers on the development path and the possibility of improving the situation with the implementation of AIED. The questionnaire is presented in Table 2. The participants could clarify and justify some of their answers during the interview. The key interview questions: does your university faculty use AI for student learning? How do you assess the academic achievements of education based on AI or online learning? What steps should be taken to introduce AI at your university?

Table 2. Questionnaire item

| Question | Type of answer |
|---|---|
| Have you ever heard about the concept of AI and its application in education? | (Yes, No) |
| Does your university have good equipment to introduce AI in the educational process? | (Yes, No) |
| Will AI replace teachers in the future? | (Yes, No) |
| Will AI partially replace teachers in the future? | (Yes, No) |
| Can AI provide personalized learning for students? | (Yes, No) |
| Is there a need for personalized learning at your university? | (Yes, No) |
| Are there any duties and responsibilities of teachers that cannot be replaced by AI? | (Yes, No) |
| Is it effective to use only AI for teaching students? | (Yes, No) |
| Is it effective to use AI as an addition to traditional student learning? | (Yes, No) |
| Have you ever used AI to teach students? | (Yes, No) |

The questionnaire was based on the findings from academic research on the implementation of AI in pedagogical processes in various countries. The validity of its content was tested in discussions with faculty from both universities included in the study. In total, 172 teachers took part in assessing the validity of the questionnaire, including all participants in the study (survey). The discussion was carried out via e-mail. The final form of the questions was established after reaching a consensus among all participants regarding the completeness of the coverage of the issues under study, the accuracy of their definition, and the attitude of the respondents towards them, as well as the relevance of the object under investigation. The study utilized Cronbach's coefficient to determine the internal consistency and reliability of the questionnaire. This coefficient shows how interconnected and homogeneous the internal elements of the tests are. The obtained result $\alpha=.769$ indicates that the internal consistency of the questionnaire is sufficient for the purposes of the study.

The facial validity of the proposed questionnaire was tested using two subsequent surveys: among 172 teachers who participated in the formulation and then among a group of 32 specially selected experts. The experts had at least 3 publications in peer-reviewed academic journals on AI-based education and at least 3 years of experience in implementing AI learning technologies at a university. The assessment was carried out using a 5-point Likert scale, with 1 point being "minimum validity" and 5 points being "maximum validity". The survey among teachers showed mean=4.78, SD=.21; results among experts showed mean=4.39, SD=.28. Based on these results, the facial validity of the questionnaire can be considered sufficient for the purposes of the study. The study also used the concordance coefficient to test the validity of the method. The coefficient takes values not lower than .61, which indicates sufficient validity of the method. Figure 1 shows the sequence of research stages.

### 3.2. Data analysis

As described, the survey included a 10 questionnaire of questions. The responses were further analyzed on the basis of descriptive statistics (generalized in Table 3). The structure of the questionnaire allowed the authors to collect an array of assessments that were not differentiated by specific categories. The interview responses of the participants were reviewed by three specially selected experts. Ultimately, the proposed formulations were validated by all participants in the study, which guarantees their validity within the research method.
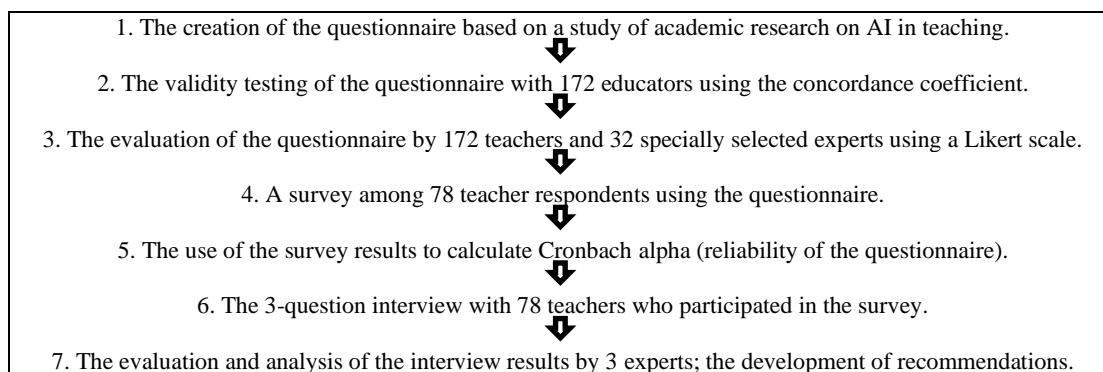
1. The creation of the questionnaire based on a study of academic research on AI in teaching.

⬇

2. The validity testing of the questionnaire with 172 educators using the concordance coefficient.

⬇

3. The evaluation of the questionnaire by 172 teachers and 32 specially selected experts using a Likert scale.

⬇

4. A survey among 78 teacher respondents using the questionnaire.

⬇

5. The use of the survey results to calculate Cronbach alpha (reliability of the questionnaire).

⬇

6. The 3-question interview with 78 teachers who participated in the survey.

⬇

7. The evaluation and analysis of the interview results by 3 experts; the development of recommendations.

Figure 1. The stages of research

## 4. RESULTS
### 4.1. Survey results

Table 3 presents the survey results. Thus, a total of 10 questions were presented. The summation of respondents' answers (qualitative and quantitative) is also described.

Table 3. Teachers' answers to the questionnaire

| No | Question | Answer |
|---|---|---|
| 1 | Have you ever heard about the concept of AI and its application in education? (Yes, No) | About 82% of the participants answered positively and 18% answered negatively to this question. Most of the teachers knew about AI and its advantages for education. |
| 2 | Does your university have good equipment to introduce AI in the educational process? (Yes, No) | More than a third of the teachers (38%) answered positively and 62% answered negatively to this question. The universities in the Russian Federation and Kazakhstan lack the resources to introduce AIED. It is important to allocate funding for purchasing the equipment and involve AI specialists to integrate innovative solutions in education. |
| 3 | Will AI replace teachers in the future? (Yes, No) | Only 11% of the participants agreed and 89% disagreed that AI would replace teachers in the future. Most teachers admitted that the transition to online learning powered by AI would not be possible. Despite great technological changes, AI has not reached its full potential yet. |
| 4 | Will AI partially replace teachers in the future? (Yes, No) | More than half of the participants (56%) answered positively and 44% answered negatively to this question. In the future, according to the teachers, only some of their duties and responsibilities would be performed by machines and automated. |
| 5 | Can AI provide personalized learning for students? (Yes, No) | About two-thirds of the participants (69%) agreed and 31% disagreed with this question. The majority of the teachers believed that AI-powered tools used for personalized learning are effective. |
| 6 | Is there a need for personalized learning at your university? (Yes, No) | About 32% of the teachers answered positively and 68% answered negatively. The majority of the teachers worked at universities where there was no need for personalized education. Still, more information is required on the individual approach to learning. |
| 7 | Are there any duties and responsibilities of teachers that cannot be replaced by AI? (Yes, No) | According to 93% of the respondents, machines cannot replace teachers. Only 7% of the respondents disagreed with this statement. Nevertheless, it is necessary to develop AI-powered tools for educational purposes. |
| 8 | Is it effective to use only AI for teaching students? (Yes, No) | The results showed that 17% of the teachers agreed and 83% disagreed with this question. Most educators do not support a full transition to AI-powered learning. They question its effectiveness for students. The research supposes that this situation is a result of no experience in that role. |
| 9 | Is it effective to use AI in addition to traditional student learning? (Yes, No) | The findings suggested that 43% of the participants answered positively and 57% answered negatively to this question. Less than half of the participants support the introduction of AI-powered tools in the educational process. The results may change if teachers gain knowledge and experience in that role. |
| 10 | Have you ever used AI for student learning? (Yes, No) | While 24% of the participants answered positively, 76% answered negatively to this item. Only a small percentage of teachers have experience in using AI. Universities should buy equipment and use MOOCs for learning. |

### 4.2. Interview results
#### 4.2.1. Examples of responses to the interview question

Some participants (33.3%) indicated that their faculty did not use AI for student learning. All of them specified that some of their colleagues could independently use such methods, but the participants were not aware of this. Most of the respondents (66.7%) confidently stated that their faculty used AI in teaching

and were able to give examples. According to the results, 75% of teachers had a positive opinion on the use of AI and personalized learning in education, 15% remained neutral, and 10% expressed a negative opinion on the issue of AI-generated solutions.

> Respondent 1: "*AI is not used at our university. During the transition to online education, there were technical problems such as poor Internet connection. I think it is too early to discuss a full transition to personalized learning using AI-powered tools to help students develop their skills.*"
> Respondent 2: "*I believe personalized learning is important for education. Mass education cannot meet the needs of every student, and as a result, many students cannot reach their full potential. As for the place of AI in the educational process, it is better to use AI-generated solutions as a part of the traditional classroom.*"
> Respondent 3: "*Students take MOOCs at our university. Students like these courses, but they complain that learning materials are obscure and interconnected, and there is no opportunity to ask questions. Some teachers use AI to test students' knowledge.*"
> Respondent 4: "*In my opinion, AI will never replace communication between teachers and students. Social interaction is important for individuals and they cannot avoid face-to-face communication. For this reason, distance learning powered by AI will be ineffective and stressful for young students. There are technical innovations that can be launched during face-to-face classes such as MOOCs, tests, VR, and a game approach.*"
> Respondent 5: "*Our university does not need personalized learning. Students must attend all courses and learn all academic materials provided by teachers. If they need, they can use additional resources and learn additional materials on any issues they consider important to them.*"
> Respondent 6: "*Many of our students are taking MOOCs courses. They learn the basics of IT and foreign languages. Some of the courses deepen and expand knowledge mastered at the university. Such courses are important because they can improve knowledge and inspire self-education.*"
> Respondent 7: "*I believe that AI-powered tools should be introduced into modern education. However, the results of distance learning are not positive for all stakeholders. For a long time, the traditional educational forms have remained intact.*"
> Respondent 8: "*Lifelong learning for personal and professional reasons is a vital point of modern life. In the future, some students may even change their career paths. They should understand that it may not be possible to study at a university at an older age. MOOCs courses will help them to master new knowledge and skills. One of the main tasks of educational institutions is to teach young individuals how to search for information and organize it.*"
> Respondent 9: "*Many students admit that online courses and platforms are not effective for them. They do not understand some of the information provided by instructors and cannot apply it in practice. Technological innovation can provide some kind of assistance to students to improve the existing knowledge or qualifications rather than learning a new discipline or obtaining a new profession.*"
> Respondent 10: "*The way AI-powered tools will be used in education is still unclear. The question of personalized learning in education also remains understudied. Practical application of the proposed solutions will help to identify the strengths and weaknesses of this technology. I do not recommend focusing on new AI-powered tools and replacing traditional training with new and untested approaches.*"

### 4.2.2. Implementation of artificial intelligence-powered tools and personalized learning at universities

Based on the obtained results and the findings of previous studies [1], [15], [29], it was possible to develop recommendations for teachers. These recommendations can aid in the introduction of personalized learning and tools based on AIED. Students would benefit from taking MOOCs courses while learning at the university; in turn, teachers need more knowledge about these educational opportunities. Bonus points for academic achievements would motivate students to take extracurricular courses. In most courses, it is necessary to clearly define time frames recommended for completion (typically, the recommended time is 6 weeks, so it allows students to select those courses based on desired time). The introduction of courses into the educational process can take from 6 up to 12 months.

Students could be encouraged to learn foreign languages using online platforms (for instance, Duolingo). A teacher can use a few minutes to discuss language learning experiences and the advantages of online platforms in the traditional classroom. Exams can also offer students additional points if they have a certificate of completion. If a student has certificates confirming successful completion of the courses, a teacher may assign additional points to the achievement scores.

Online labs and learning simulators are effective tools to use in the classroom. These tools are widely utilized in medicine (simulators), engineering (online laboratories), pharmaceuticals, and other areas of education. They help teachers to teach students using simulators and model real-life situations by analyzing a problem and inspiring student interest. Nevertheless, online platforms and simulators are expensive learning tools. They are not available in all universities in the Russian Federation and Kazakhstan. The implementation of the proposed technological solutions requires expensive equipment and additional classroom materials.

Students should be encouraged to test their knowledge and skills online. There are many internet resources available to students to test knowledge in any discipline. Students can assess knowledge in foreign languages, mathematics, biology and other disciplines. Educators recommend these tests as an additional tool for university exams. Universities can create online tests for any discipline. Both teachers and students would benefit from lectures on AI-generated tools. During lectures, instructors should explain and demonstrate the potential of AI tools and personalized learning, the current state of the problem and ensure administration support. The research recommends organizing lectures for teachers and students and discussing the experience in separate groups. Universities need an appropriate technical base to introduce AI-generated solutions. This also implies additional funding to purchase computers, software, pay IT developers, and pay for training. At the same time, it is necessary to carefully consider the specifics of each university.

The opinion of teachers on AI and learning personalization at the university level is critical to understanding how the process of inevitable implementation of this leading technology can go, and what difficulties it will face [1], [15]. The recommendations will help educators adapt the learning process for the (partial) transition to AI-powered personalized learning in the future. The research participants and the scholars highlight that personalized learning is important for individuals who cannot navigate the torrent of information and delegate it to a machine [1]. University students are provided with group learning and do not need personalized learning [15]. Chinese scientists admit that recommendations on the learning process help those students who cannot make the right choice [29]. Learning recommendations include advice on information searching or filtering that present a vital point in education. There are two basic filtering classes, collaborative and content-based, as well as an intermediate hybrid filtering class [29].

## 5. DISCUSSION

AI has not met the communication needs of students and fails to ensure effective feedback to improve student engagement. The results of the proposed study indicate significant uncertainty among teachers about the quality of teaching offered by AI, although they do not doubt the good prospects. The research reveals that students complain about the lack of live communication with other students. Ineffective communication prevents teachers to communicate with one another. The authors from Chile underline that communication is a core of social interaction, and social relations are based on effective communication [33]. Another survey also investigated the potential of AI as an alternative to self-learning. The results showed that 74% of students fully agreed, 7% agreed, 14% disagreed, and 5% completely disagreed to consider AI an alternative to self-learning [34]. Australian scholars argue that learning analytics should expand its focus on data research and ensure effective learning support for students [31]. It involves personalized feedback and hybrid approaches. Instructors interpret the data and choose the appropriate course of action [31]. The research recommends that AI should be integrated into education more extensively and provide effective feedback for students, which is in line with the needs expressed by teachers in our survey.

The research suggests that personalization of learning based on AI is less developed in education than in other areas (for example, trade or banking sectors), where it has been successfully used for many years. Personalization has already been implemented as a distinct approach to learning based on constructivist discourse, and AI can fit into this process as a natural continuation and extension of it [3], [12]. The US authors highlight that personalization is widely used in customer services tailored to specific needs of buyers and using recommendation systems, customized interfaces or avatars, and promotional merchandise [10]. The researchers underline that enterprise set-ups (e.g., Amazon, Pandora) are the core for personalized learning and this type of interface customization creates an illusion of control instead of a deep understanding of the interests and goals of individuals [10].

University professors believe that AI-powered personalized learning cannot replace traditional classrooms. There are many reasons including lack of live communication, inability to identify emotions, lack of discipline, and inadequate assessment. The author from Australia argues that schools (places designed to provide a learning environment for children) will exist 25 years from now and the role of a teacher will remain unchanged: to control and encourage learning among school-aged students. The author suggests that cobots (robot co-workers) will help teachers in the classrooms of the future. The researchers also predicts that smart classrooms will be created to support the learning process [35]. The research demonstrates the relationship between concerns and some prejudice regarding the effectiveness of AI as a substitute for teacher functions expressed by teachers in this study.

The authors from India and the research participants recognize that AI is useful in higher education to promote students' success and improve academic performance. The current technologies are underdeveloped and unable to perform all of the expected educational tasks. It will likely take some time before AI-generated tools can be fully integrated into education. Chatbots will provide personalized assistance to students and answer questions outside the classroom. AI-generated systems can also be used in enrolment management, administrative decision making, and other areas. The AI-powered tools include digitalized textbook guides and customized digital classroom screens [36]. The findings of the current study point to the importance of understanding teachers' attitudes towards AI-based learning, since teachers act as the main promoters of it in developing countries.

Other authors conducted a survey to study the importance of AI in learning. The results showed that 88% of students fully agreed, 9% agreed, 2% disagreed, and 1% disagreed at all that AI is important for learning [34]. In turn, in the current study, 43% of respondents recommended integrating AI into the educational process as an aid to traditional teaching methods. During the interview, 85% of teachers supported the introduction of AI and personalized learning in universities. The findings suggest that AI and personalized learning can successfully supplement the traditional learning process. Contrary to some concerns of previous researchers, the findings of this study, based on the real experience of teachers, indicate that the implementation of AI does not necessarily mean a fundamental change in the paradigm of education and all its processes [16], [29]. Nevertheless, AI-generated tools cannot replace the traditional learning and teachers functions because such tools are still underdeveloped. The final suggestion of the research is the need to develop appropriate technical support for universities, as well as the preliminary training of teachers and students in the use of AI-based pedagogical tools. These supportive measures would increase the effectiveness of classroom and online teaching and the spreading of AI into the field of personalized learning. The proposed findings could be of use to future researchers in studying the processes of real implementation of AI-based educational technologies. The findings could be used to understand how these technologies interact with not only students but also teachers. The opinion of teachers is critical for identifying the weaknesses and challenges of technology in scope of its interaction with the educational environment.

The findings of this study have some practical implications for educational practice and policy. Thus, 62% of teachers believed that their educational institutions sufficiently developed technical capabilities to implement AI. Therefore, there is a need to provide educational institutions with appropriate equipment and infrastructure. To successfully implement AI in the educational process, it is necessary to consider opportunities for professional training of teachers. The results of the study can serve as a basis for developing curricula and seminars aimed at improving the digital competence of teachers.

It is crucial to continuously improve AI-based tools, especially given the lack of face-to-face communication and difficulty recognizing emotions that teachers have identified as problematic moments. Government and educational authorities can define strategies and programs to support research and innovation in the educational process. The relevant measures may be funding and support for projects focused on improving educational technologies.

Overall, the results of this study point to the potential for improving education quality through AI. At the same time, the findings highlight the need for an integrated approach. The study necessitates collaboration between teachers, technology developers, and educational authorities to achieve the most effective results.

## 6. CONCLUSION

The study analyses the use of AI in the educational process and investigates the impact of this technology on personalized learning by assessing the attitude of teachers to these aspects. This study is of significant practical and academic benefit for the scientific development of methods and principles for implementing AI in pedagogical processes. It provides basic reference data on the opinions of teachers involved in this process locally, as well as recommendations based on their unique experience. Moreover, it lays the groundwork for future research aimed at optimizing AI tools to better meet the needs of both educators and students in diverse educational settings.

The findings indicate that 82% of the teachers knew about the concept of AI and personalized learning but 33.3% of the participants indicated that their faculty did not use AI. Most participants (76%) had no experience using AI-powered personalized learning to teach students; and 62% believed that the equipment and technology of universities under study were outdated and could not be successfully integrated with AI-powered tools. The findings suggest that 89% of the respondents assumed that AI would not replace teachers' functions in the future. For 69% of the teachers, AI is effective for personalized learning of students, but 68% underlined lack of need to introduce educational AI tools. In total, 75% of the teachers had a positive opinion on the use of AI and personalized learning in education.

The results are reliable. The research was controlled by the instructors and recorded on a tape recorder. There are no irrelevant results. Nevertheless, the research involved only two universities in the Russian Federation and Kazakhstan with a limited sample size. The results rest on descriptive statistics and expert analysis of the interviews among participants. This fact suggests the need for further research in this direction using statistical quantitative methods.

Based on the findings and limitations of the current study, it is possible to offer the following recommendations for future research and educational practice. Given the limited sample size and location of universities, it is recommended to expand geographical boundaries to get more representative results. Since the study was limited to two countries and specific disciplines, it is recommended to expand the sample to include more universities and subjects. Further development of the technical infrastructure of universities is essential. Most teachers noted the lack of technical capabilities for implementing AI. Therefore, it is recommended to further improve the technical infrastructure to support innovation in education. There is a need to develop AI tools for educational purposes. Future studies will include the development and improvement of AI tools, focusing on the real requirements of the educational process. These recommendations can contribute to the further development of the area and have practical implications for educational practices and policies.

## REFERENCES

[1]    T. Surma and P. A. Kirschner, "Technology enhanced distance learning should not forget how learning happens," *Computers in Human Behavior*, vol. 110, p. 106390, Sep. 2020, doi: 10.1016/j.chb.2020.106390.
[2]    M. Ciolacu, A. F. Tehrani, L. Binder, and P. M. Svasta, "Education 4.0 - Artificial intelligence assisted higher education: early recognition system with machine learning to support students' success," in *2018 IEEE 24th International Symposium for Design and Technology in Electronic Packaging (SIITME)*, Oct. 2018, pp. 23–30, doi: 10.1109/SIITME.2018.8599203.
[3]    A. Bundy, "Preparing for the future of artificial intelligence," *AI & SOCIETY*, vol. 32, no. 2, pp. 285–287, May 2017, doi: 10.1007/s00146-016-0685-0.
[4]    S. K. S. Cheung, F. L. Wang, L. F. Kwok, and P. Poulova, "In search of the good practices of personalized learning," *Interactive Learning Environments*, vol. 29, no. 2, pp. 179–181, Feb. 2021, doi: 10.1080/10494820.2021.1894830.
[5]    M. Somasundaram, K. A. M. Junaid, and S. Mangadu, "Artificial intelligence (AI) enabled intelligent quality management system (IQMS) For personalized learning path," *Procedia Computer Science*, vol. 172, pp. 438–442, 2020, doi: 10.1016/j.procs.2020.05.096.
[6]    I. Roll and R. Wylie, "Evolution and revolution in artificial intelligence in education," *International Journal of Artificial Intelligence in Education*, vol. 26, no. 2, pp. 582–599, Jun. 2016, doi: 10.1007/s40593-016-0110-3.
[7]    S. T. H. Pham and P. M. Sampson, "The development of artificial intelligence in education: a review in context," *Journal of Computer Assisted Learning*, vol. 38, no. 5, pp. 1408–1421, Oct. 2022, doi: 10.1111/jcal.12687.
[8]    F. Pedro, M. Subosa, A. Rivas, and P. Valverde, *Artificial intelligence in education: challenges and opportunities for sustainable development*. UNESCO, 2019.
[9]    H. Peng, S. Ma, and J. M. Spector, "Personalized adaptive learning: an emerging pedagogical approach enabled by a smart learning environment," *Smart Learning Environments*, vol. 6, no. 1, p. 9, Dec. 2019, doi: 10.1186/s40561-019-0089-y.
[10]    C. Walkington and M. L. Bernacki, "Appraising research on personalized learning: definitions, theoretical alignment, advancements, and future directions," *Journal of Research on Technology in Education*, vol. 52, no. 3, pp. 235–252, Jul. 2020, doi: 10.1080/15391523.2020.1747757.
[11]    R. Bajaj and V. Sharma, "Smart education with artificial intelligence based determination of learning styles," *Procedia Computer Science*, vol. 132, pp. 834–842, 2018, doi: 10.1016/j.procs.2018.05.095.
[12]    F. Ouyang and P. Jiao, "Artificial intelligence in education: the three paradigms," *Computers and Education: Artificial Intelligence*, vol. 2, p. 100020, 2021, doi: 10.1016/j.caeai.2021.100020.
[13]    V. N. Gudivada, "Cognitive analytics driven personalized learning," *Educational Technology*, vol. 57, no. 1, pp. 23–31, 2017.
[14]    D. B. Shank, C. Graves, A. Gott, P. Gamez, and S. Rodriguez, "Feeling our way to machine minds: people's emotions when perceiving mind in artificial intelligence," *Computers in Human Behavior*, vol. 98, pp. 256–266, Sep. 2019, doi: 10.1016/j.chb.2019.04.001.
[15]    H. Xie, H.-C. Chu, G.-J. Hwang, and C.-C. Wang, "Trends and development in technology-enhanced adaptive/personalized learning: a systematic review of journal publications from 2007 to 2017," *Computers & Education*, vol. 140, p. 103599, Oct. 2019, doi: 10.1016/j.compedu.2019.103599.
[16]    H. Thomas, "Powerful knowledge, technology and education in the future-focused good society," *Technology in Society*, vol. 52, pp. 54–59, Feb. 2018, doi: 10.1016/j.techsoc.2017.09.005.
[17]    M. Chassignol, A. Khoroshavin, A. Klimova, and A. Bilyatdinova, "Artificial intelligence trends in education: a narrative overview," *Procedia Computer Science*, vol. 136, pp. 16–24, 2018, doi: 10.1016/j.procs.2018.08.233.
[18]    I. A. Zualkernan, "Personalized learning for the developing world," in *The Future of Ubiquitous Learning. Lecture Notes in Educational Technology*, Berlin, Heidelberg: Springer, 2016, pp. 241–258, doi: 10.1007/978-3-662-47724-3_13.
[19]    K.-Y. Tang, C.-Y. Chang, and G.-J. Hwang, "Trends in artificial intelligence-supported e-learning: a systematic review and co-citation network analysis (1998–2019)," *Interactive Learning Environments*, vol. 31, no. 4, pp. 2134–2152, May 2023, doi: 10.1080/10494820.2021.1875001.

[20] D. L. Taylor, M. Yeung, and A. Z. Bashet, "Personalized and adaptive learning," in *Innovative Learning Environments in STEM Higher Education*, J. Ryoo and K. Winkelmann, Eds. Cham: Springer, 2021, pp. 17–34, doi: 10.1007/978-3-030-58948-6_2.

[21] S. Ghallabi, F. Essalmi, M. Jemni, and Kinshuk, "Reuse of e-learning personalization components," *Smart Learning Environments*, vol. 9, no. 1, p. 32, Nov. 2022, doi: 10.1186/s40561-022-00214-w.

[22] V. Mikić, M. Ilić, L. Kopanja, and B. Vesin, "Personalisation methods in e-learning-a literature review," *Computer Applications in Engineering Education*, vol. 30, no. 6, pp. 1931–1958, Nov. 2022, doi: 10.1002/cae.22566.

[23] A. Shemshack, Kinshuk, and J. M. Spector, "A comprehensive analysis of personalized learning components," *Journal of Computers in Education*, vol. 8, no. 4, pp. 485–503, Dec. 2021, doi: 10.1007/s40692-021-00188-7.

[24] S. Maity, "Identifying opportunities for artificial intelligence in the evolution of training and development practices," *Journal of Management Development*, vol. 38, no. 8, pp. 651–663, Sep. 2019, doi: 10.1108/JMD-03-2019-0069.

[25] L. Jensen and F. Konradsen, "A review of the use of virtual reality head-mounted displays in education and training," *Education and Information Technologies*, vol. 23, no. 4, pp. 1515–1529, Jul. 2018, doi: 10.1007/s10639-017-9676-0.

[26] O. A. Fiofanova, "Data analysis competencies in professional standards: from data-experts to evidence-based education," in *Advances in Natural, Human-Made, and Coupled Human-Natural Systems Research,* S. Maximova, R. I. Raikin, A. A. Chibilev, and M. M. Silantyeva, Eds. Cham: Springer, 2021, pp. 1–7.

[27] O. A. Fiofanova, "Data architecture on digital educational platforms and data- competence of teachers," *Revista on line de Política e Gestão Educacional*, vol. 25, no. 3, pp. 1762–1778, Aug. 2021, doi: 10.22633/rpge.v25iesp.3.15591.

[28] I. V. Ershova, E. E. Elkova, A. U. Petrakov, V. A. Laptev, and O. A. Fiofanova, "Architecture of university educational processes in the COVID-19 pandemic: from small data to big data and data science," in *Advances in Natural Human-Made and Coupled Human-Natural Systems Research. Lecture Notes in Networks and Systems*, S. G. Maximova, R. I. Raikin, A. A. Chibilev, and M. M. Silantyeva, Eds. Cham: Springer, 2021, pp. 1-8.

[29] Y. Zhou, C. Huang, Q. Hu, J. Zhu, and Y. Tang, "Personalized learning full-path recommendation model based on LSTM neural networks," *Information Sciences*, vol. 444, pp. 135–152, May 2018, doi: 10.1016/j.ins.2018.02.053.

[30] K. S. McCarthy, M. Watanabe, J. Dai, and D. S. McNamara, "Personalized learning in iSTART: past modifications and future design," *Journal of Research on Technology in Education*, vol. 52, no. 3, pp. 301–321, Jul. 2020, doi: 10.1080/15391523.2020.1716201.

[31] A. Pardo *et al.*, "OnTask: delivering data-informed, personalized learning support actions," *Journal of Learning Analytics*, vol. 5, no. 3, pp. 235–249, Dec. 2018, doi: 10.18608/jla.2018.53.15.

[32] A. E. Berndt, "Sampling methods," *Journal of Human Lactation*, vol. 36, no. 2, pp. 224–226, May 2020, doi: 10.1177/0890334420906850.

[33] J. S. Avery, *Information theory and evolution*, 3rd ed. Singapore: World Scientific, 2021.

[34] M. P. Pratama, R. Sampelolo, and H. Lura, "Revolutionizing education: harnessing the power of artificial intelligence for personalized learning," *KLASIKAL : Journal of Education, Language Teaching and Science*, vol. 5, no. 2, pp. 350–357, Aug. 2023, doi: 10.52208/klasikal.v5i2.877.

[35] A. Singh, "Pedagogical shift in education: artificial intelligence-based practices," in *Revolutionizing Business Practices Through Artificial Intelligence and Data-Rich Environments*, M. Gupta, D. Sharma, and H. Gupta, Eds. IGI Global, 2022, pp. 50–72, doi: 10.4018/978-1-6684-4950-9.ch004.

[36] S. Chatterjee and K. K. Bhattacharjee, "Adoption of artificial intelligence in higher education: a quantitative analysis using structural equation modelling," *Education and Information Technologies*, vol. 25, no. 5, pp. 3443–3463, Sep. 2020, doi: 10.1007/s10639-020-10159-7.

# BIOGRAPHIES OF AUTHORS

**Olga Agatova** is a Doctor of Science, Professor of the Department of Psychology and Pedagogy, Faculty of Philology at the Peoples Friendship University named after Patrice Lumumba. Her current interests are digital educational environment, AI and communication. She can be contacted at emails: o_agatova@gmx.com, olga_agatova@mail.ru.



**Liliya Latipova** is a Candidate of Pedagogical Sciences at Kazan Federal University. Her current interests are learning strategy, smart learning environment and vocational education. She can be contacted at email: latipovalill@rambler.ru.