2021 IEEE Smart Information Systems and Technologies (SIST)
28-30 April, 2021, Nur-Sultan, Kazakhstan

2021 IEEE International Conference on Smart Information Systems and Technologies (SIST) | 978-1-7281-7470-9/20/$31.00 ©2021 IEEE | DOI: 10.1109/SIST50301.2021.9465974

Introduction of Artificial Intelligence as the Basis of Modern Online Education on the Example of Higher Education

Aigul Syzdykbayeva[1*], Aigerim Baikulova[2], Rysty Kerimbayeva[3]
[1*]Abay Kazakh National Pedagogical University, Kazakhstan, sizdikbaeva-aya@mail.ru
[2]Abay Kazakh National Pedagogical University, Kazakhstan, aigerim.baikulova@mail.ru
[3]M. Kh. Dulaty Taraz State University, Kazakhstan, risti1971@mail.ru

***Abstract* – The article deals with the process of awareness and acceptance of artificial intelligence in the educational process of higher education during the quarantine period. The state of the teacher is considered through the prism of the model of stages of experiencing grief by E. Kubler-Ross. This demonstrates the diversity and complexity of the transition to distance (online) learning. The genesis of the development and the role of information technologies based on artificial intelligence in education at the present stage is determined. Based on research by D. Tatar, J. Roschelle, P. Vahey, W. R. Penuel determined that the highest peak of the development of artificial intelligence and its active implementation in educational technologies refers to the period from 1999 to 2019. The authors highlight the approaches of informatization of the university. The Abai KazNPU has defined a way to build up the integrated digital management system of the university through the univer system. Artificial intelligence programs are highlighted: adaptive and personalized learning, automatic assessment, intermediate learning interval, chatbot, virtual assistants, proctoring and gamification. The authors analyze their own experience of implementing and further actively using artificial intelligence techniques and technologies using the Google Classroom, Kahoot, and Lingualeo platforms in the teaching process. The article presents the results of a survey among the university teaching staff to identify the degree of job satisfaction in the conditions of distance learning. The results of the survey for the autumn half-year of 2020-2021 showed that artificial intelligence is becoming a full-fledged participant in the educational process and occupies a central place in the process of intellectualization of society and the development of the education system as a whole. The progress and technological effectiveness of this process cannot be stopped. It was decided to introduce the elective discipline "Artificial Intelligence" at the bachelor's and master's level, with the continuity of the formed competencies for advanced training in artificial intelligence in the field of educational technologies.**

Keywords – artificial intelligence, higher education, artificial intelligence techniques and technologies, adaptive and personalized learning, automatic assessment, intermediate learning interval, chat bot, virtual assistants, proctoring, gamification.

I. INTRODUCTION

From March 13, 2020 to the present, something happens in the world and in our minds that did not happen before. Two weeks of complete lockdown, almost a year we live in special quarantine conditions, moving from the green zone to the yellow, red and back, and it is still unclear when exactly all this will end and when we will be able to return to our previous living conditions.

American psychiatrist Elizabeth Kubler-Ross [1] based on her research proposed a model of the stages of experiencing grief, which conveys the state of each teacher: denial – we did not accept the situation around education, held a pause, for a period it seemed to us that everything hung in the air. 90% of the main reaction is anger, aggression through the slogan: "Return the traditional form of education!". Next, a bargain or a desire to negotiate, as we begin to understand the need to master information technologies and artificial intelligence techniques. Depression follows, because there is a sense of difficulty in mastering the techniques of artificial intelligence, but at the same time awareness, and the way out of depression is the final internal acceptance of the situation-education will not be as before!

A The genesis of information technology development

Since 1990, we have used technical training tools in our domestic teaching practice, then, in 1996, automated programs and computers, then personal computers. Teachers "talked" a lot, but in fact, we did not actively use information technologies, since the teaching profession is implemented in the "Person-Person" system. It was impossible to imagine that the teacher could be replaced by iRobot. It seemed to us that the humanization of the learning process, which requires human qualities such as empathy and compassion, was being erased [2-6].

However, the pandemic left us all without the right to choose, and for the first time we consciously began to study and gradually use the possibilities of implementing artificial intelligence in the educational process. And what happened in the world? Although, the concept of AI and intelligent machines can be dated back to the 14th century [7], the idea of AIEd is only 25 years old. This is confirmed by the data from the publication of 143 articles on AIEd

from six well-known SSCI journals [8-11] (for example, Computers & Education, Educational Technology Society, Interactive Learning Environments, British Journal of Educational Technology , Education Technology Research and Development, and Journal of Computer Assisted Learning), related to educational technologies, were published in the period 1999-2019 (Figure 1).

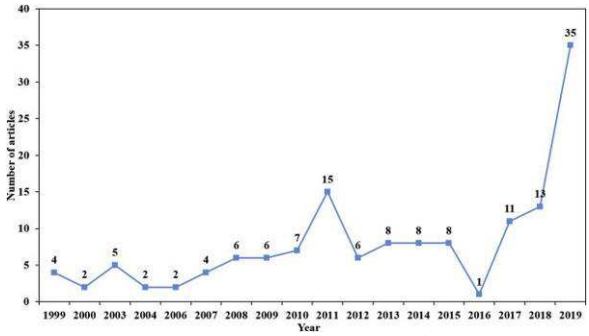

Figure 1. Analysis of publications on the introduction of artificial intelligence in education

According to the results of research, we have practically developed in the same way, in the world, more attention to the introduction of artificial intelligence in the educational process began actively from 2018-2019, on the example of China [12], but our awareness was more than 1.5-2 years late. The period is small, but for the world of technology – a huge gap.

The pandemic has contributed to a faster awareness and more active implementation of techniques, technologies, and applications of artificial intelligence in education.

B Approaches to informatization of the university

For the high-quality organization of the learning process, university management and decision-making, complete informatization was necessary. Informatization of any organization and university, in particular, is a large-scale task, for which two approaches are currently used [13]. The first approach is based on the implementation of so-called Enterprise Resource Planning systems, which are large software complexes that require serious material and organizational investments.

The second approach is to build an integrated management system of the organization from the bottom up. As part of the second approach, the process of informatization of the university's management was gradual and was based on existing developments, software tools and systems. We followed the path of this approach, since Abai KazNPU has been using the univer system for more than 8 years [14]. This system is built on the “client-server” technology and provides a multi-user mode of operation in a corporate computer network with a large number of terminals at departments, faculties, departments of educational management and other departments of the university. The univer system provides a significant increase in the level of organization and efficiency of university management with the use of modern computer technology. This contributed to further improvement:

- the work of a single corporate network infrastructure and a single development management center, providing the development of information subsystems, specialized software tools aimed at automating the tasks facing the university;
- creation of a comprehensive information model of the university;
- development of a system that includes access to all information resources of the university;
- personnel management;
- the management of educational process;
- document management and more.

Artificial intelligence has become a valuable tool for any teacher, helping them, by analyzing the learning style, strategy, and overall progress of the student, to find the most optimal learning strategies to improve their level.

II. METHOD

Currently, there are many artificial intelligence programs that help in education, thanks to which students and teachers receive huge benefits. A huge advantage is that the educational platform adapts according to the needs of students. An artificial intelligence software development system helps scientists work on their weaknesses. During the process, the program detects where the student is experiencing difficulties and sends the necessary materials to improve their skills. Adaptive learning uses a basic artificial intelligence algorithm. Besides, education at any convenient time is undoubtedly a huge plus for the student. Consider these programs.

A Characteristics of artificial intelligence programs: adaptive and personalized learning

Adaptive and personalized learning. It is defined as a learning model that uses new technologies to improve the level of knowledge of the student, taking into account his individual characteristics (emotional state, gender, ability to perceive different types of information, the level of learning skills). The learning process should "adapt" to the student, determine the amount of his or her knowledge and build an individual learning trajectory. Adaptive platforms include: 2U, Wiley, Canvas, Loud Cloud, Blackboard, Knewton, Realize IT, Adaptcourseware, Anewspring, Geekie, Smart Sparrow. The most widespread idea of adapting the learning process was in the United States. There are several platforms and online services that are used in different parts of the education system.

The educational service (platform) Knewton has been engaged in the personalization of learning since 2008. Knewton is a platform based on which programs and applications with adaptive functionality are developed. An example of such work was the MyLab & Mastering series project. The analytical system allows you to answer such questions as: 1) what the student knows; 2) why he or she made a mistake in the task; 3) what topics are important to

him or her; 4) the forecast of success at this stage. The algorithms of the Knewton platform are used by large universities not only in the USA, but also in Europe.

Intelligent Adaptive Learning technology tracks the actions of each student and evaluates the strategies used to solve problems. Then, the program adjusts the lesson material and the level of difficulty, the number of hints, topics and the pace of study.

In Australia, Smart Sparrow is an open learning platform that allows you to create interactive and adaptive training courses. This platform is a web package and is based on the "small data" approach, which uses algorithms that analyze only the most recent answers (choices) of the student to determine the next question. The teacher has the opportunity to establish feedback with the student in the form of timely hints (videos, graphics, or additional material) when it is difficult to answer a question, the number of request attempts varies, or the time of inactivity [15].

In Russia, in 2015, an attempt was made to create an adaptive Stepik platform, which selected educational material depending on the level of knowledge of the user and advised the most important for this stage of training. Today, this educational platform exists as a designer of free open online courses with adaptive recommendations, it allows you to create interactive training lessons with feedback and automatic verification [16].

B Characteristics of artificial intelligence programs: organization of feedback

Smart assessment. A specialized computer program based on artificial intelligence that simulates the behavior of a teacher who puts downgrades for essays, assignments, and IWS in an educational environment. It can evaluate students knowledge, analyze their responses, provide feedback, and make individual learning plans [17].

As displayed in Table 1, findings on smart assessment, including defining and evaluating students' learning outcomes using a good grading policy [18], evaluating students' learning behaviors using a good learning strategy, and evaluating students' learning difficulties, enable teachers to adjust their teaching strategies and materials according to students' learning effectiveness, behaviors, and difficulties [19]. Categorizing students' learning patterns and predicting their learning effectiveness is useful in exploring the correlation between learning effectiveness and learning patterns [20]. Timely counseling can be provided on the basis of students' learning patterns. Defining and assessing students' motivation, attention, and engagement and designing learning activities for improving these areas could enhance their learning [21].

Table 1. Smart assessment research topics

Assessment of learning behavior, patterns and strategy	**Automation and AI-enabled intelligence**
1. Evaluate students' learning behavior with good learning strategy.2. Adjust teaching strategies and teaching materials design according to students' learning effectiveness. 3. Categorize students' learning patterns. 4. Predict students' learning effectiveness and find out the correlation between learning effectiveness and learning patterns. 5. Define and assess students' motivation, attention, and engagement. 6. Differentiated and individualized learning.	1. AI-enabled conversational robot (Chabot). 2. AI-enabled personalization. 3. Smart content, learning pathway, and recommendation. 4. Automatic evaluation of students' learning outcome with grading policy. 5. Intelligent assessment and evaluation. 6. Automatic question generation. 7. Automatic grading. 8. AI-enabled plagiarism detection.

Intermediate training interval. Polish inventor P. Wozniak invented an educational application based on the interval effect. This app keeps track of what you are learning and when you are learning it. Including artificial intelligence, the app can find out when you are most likely to have forgotten the information and recommend you to repeat it. It only takes a few repetitions to make sure that the information is now stored in the memory for many years [22].

Feedback for teachers. American Joseph Weizenbaum, a professor at the Massachusetts Institute of Technology, is the founder of the first chatbot. A chatbot (from English chat-chat, bot-robot) is a computer program that can "communicate" with a person in a common language through text or voice, interaction with which is carried out through a simple, intuitive interface. Programming and launching your own chatbot based on machine learning is a complex process, involving the availability of qualified developers and interface specialists, as well as significant time and resource costs. However, it is now possible to quickly create a simple chatbot that does not require special technical skills and knowledge of programming languages.

For example, in online training, we used chatbots dedicated to the order of writing and defending the course work and passing the internship. The algorithm of interaction between the student and the teacher, structured in the chatbot, allowed students to freely navigate the stages of the work and the requirements that needed to be met. The presence of feedback through the chatbot allowed us to identify issues that remained unsolved, and to supplement the methodological materials for writing term papers and passing practical training.

Creating chatbots requires careful structuring of information, dividing it into logical blocks. Chat-bots “Coursework” and “educational practice” to users promptly and in full, communicated methodical nature:

– information about the department, the address of the department pages on the university website, e-mail addresses of teachers, the schedule of consultations;

– dates of organizational meetings for the practice, extracts from the orders of the faculty to send students to practice, deadlines and protection of term papers and reports on practice;

- the procedure and options for finding a place to practice; guidelines for writing term papers and practice reports, requirements for the design of written works at the university;

- links to the electronic library system of the university with recommendations for the design of the bibliographic list:

- forms of documents that must be issued during the internship, forms of title pages of term papers and reports on practice;

- presentations that reflect the algorithm of the teacher's work with the student when writing a course paper or when passing an internship.

The introduction of chatbots in the practice of working with students at the department allowed to improve interaction with students, gave them the opportunity to get answers to questions of interest without contacting the teacher, thereby eliminating the need for teachers to repeatedly answer the same standard questions of students, often just clarifying in nature [23].

Virtual assistants (digital volunteer). At the moment, there are already assistants for teachers who can respond accurately and immediately to students requests, thanks to their built-in computers with artificial intelligence. Last year, Abai KazNPU launched the project “Digital Volunteering”. Within the framework of this project, a lot of work was carried out to help teachers and students in case of problems with the use of digital tools and technologies (Figure 2).

Figure 2. “Digital Volunteer” Brochure

C Characteristics of artificial intelligence programs: Proctoring and gamification

Proctoring. The examination session of the 2019-2020 and the autumn half-year of the 2020-2021 academic years was held by using the security system based on artificial intelligence Proctored Test. Proctors, as in a regular exam in the classroom, control that the examinees pass the tests honestly: they complete the tasks themselves and do not use additional materials. Both a specialist (face-to-face proctoring) and a program that monitors the subject's desktop, the number of faces in the frame, extraneous sounds or voices, and even eye movements (cyber-proctoring) can monitor the online exam in real time using a webcam. A type of mixed proctoring is often used (in the format of synchronous and asynchronous proctoring): a video recording of the exam with the program's comments is additionally viewed by the discipline tutor and decides whether violations actually occurred [24].

Gamification. Artificial intelligence increases engagement through gamification. For example, the Institute of Philology used online games and training simulators that work on artificial intelligence. A good example of gamification is the service applications for learning foreign languages Lingualeo, Drops, Busuu, Duolingo, Hello English, HelloTalk, Memrise, and others [25].

Progress in the field of artificial intelligence and machine learning is impressive, but it is far from the limit of possibilities. The goal is to improve teachers’ teaching quality and students’ learning outcomes. There are a huge number of good ideas that artificial intelligence can implement. In general, artificial intelligence can significantly improve the education system due to its ability to optimize many parts of the teacher's work, giving them more and more time to spend on students [26].

Smart assessment can be improved through increased evaluation of students’ learning activities, such as preclass preview, reflection, oral reports, assignments, special topics, and program writing, and introduction of an examination mechanism into the smart evaluation system [27]. Teachers provide teaching materials (e.g., textbooks and slides), AI extracts the key concepts in texts through text summarization, and the system automatically generates test questions and reference answers (automatic question generation) to evaluate the key concept [28]). Test questions can be in Cloze [29], multiple-choice, yes/no, fill-in-the-blank, essay, or short-answer format [30]. For short-answer questions, the system can automatically compare students’ answers and reference answers with deep learning technology and provide scores and feedback. For smart evaluation, teachers provide textbooks and slides. The system uses natural language processing technology for text summarization to extract key concepts of the textbook and produce a knowledge map.

Each node on the knowledge map represents a key concept, and each edge represents the contextual relation between two connected nodes. On the basis of the key concept represented by each node on the knowledge map, the system automatically generates test questions and reference answers (automatic question generation) to evaluate the mastery of a key concept. If students' answers are in written form, then the system can automatically compare the students' answers with the reference answers and give scores (short-answer grading) using deep learning technology and provide feedback. Through repeated testing and practice [31], students can enhance their memory retention of the learned content, improve the mastery of key concepts, and achieve better performance than if they had simply restudied the learning content.

Smart learning analytics enables teachers to continually enhance educational content so that it can be tailored to students' level of understanding as they progress and monitor the performance of students so that teachers can then adapt their teaching. Smart learning analytics enables students to take control of their learning, know how they are performing in comparison with peers, and complete assessments to keep up with the learning progress of their peer group and helps teachers to identify gaps in students' prerequisite knowledge and key study skills.

Smart learning analytics can help students develop skills and knowledge in a more personalized and self-paced way, providing students with better information on how they are progressing and what they must do to meet their educational goals. Smart learning analytics also provides student consent services, which helps to ensure privacy by enabling students to decide whether to give their permission for data capture and use.

Table 2. Research topics concerning smart learning analytics

How to improve teachers' teaching quality	**How to improve students' learning outcome**
1. Identify and address topics of concern to students such as inadequate feedback. 2. Identify that students are struggling with a particular topic. 3. Provide educators better understanding of how their content is being used and how effective it is, and enable its continual enhancement. 4. Enabling the educational content to be tailored to student's level of understanding as they progress through it. 5. Monitor the performance of students so teachers can then adapt their teaching.	1. Enable students to take control of their own learning. 2. Help students develop skills and knowledge in a more personalized and self-paced way. 3. Give students better information on how they are progressing and what they must do to meet their educational goals. 4. Provide student consent service helps to ensure privacy by enabling students to give their permissions for data capture and use.

III. RESULTS

At the end of 2019-2020 and the results of the autumn half-year of the 2020-2021 academic year, we conducted a survey among the teaching staff of Abai KazNPU and M. Kh. Dulaty Taraz State University in order to identify the degree of satisfaction with the format of distance work. The questionnaire included more than 12 questions:

1. Determination of gender.
2. Academic degree.
3. Institutes.
4. Adaptability to the conditions of distance learning.
5. The level of motivation of students to study within the distance form.
6. Satisfaction with the process of teaching remotely.
7. Remote tools.
8. User of online educational resources.
9. The degree of convenience of using the distance learning center.
10. Academic load on students in online learning.
11. The load on teachers in online learning.
12. Difficulties in the process of remote work.

IV. DISCUSSION

The sample consisted of 273 teachers, from which 37 - male, 236 – female (Figure 3).

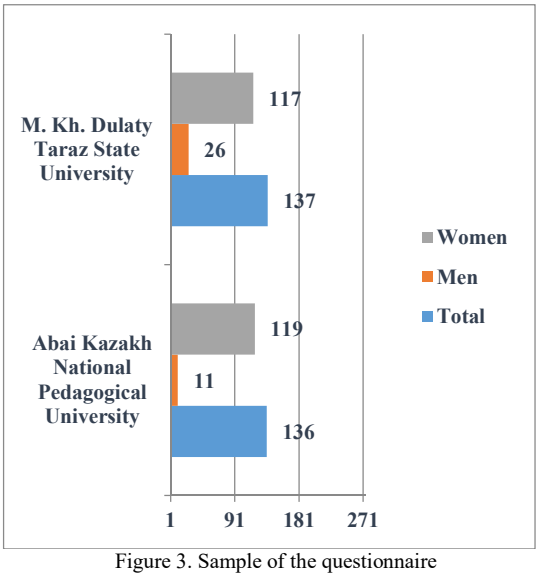

Figure 3. Sample of the questionnaire

It should be noted that men reacted more easily and less emotionally to the transition to distance learning. It was difficult for female teachers of the M. Kh. Dulaty Taraz State University to distinguish between working and home zones. However, 15% of women of Abai KazNPU noted the time savings, so for example, many of them live in the Almaty region, the travel time takes from 1.5 to 2 hours only in one direction.

It turned out to be more difficult for professors and associate professors of both universities, especially during the adaptation period, than for masters and current teachers-practitioners, first of all, we attribute this to the age (the youngest age of a doctor of science is 58 years, the average age of an associate professor is 47 years) and the practical orientation of teachers and masters who organize seminars using various teaching techniques and methods.

The Institute of Mathematics, Physics and Computer Science did not experience any difficulties in switching to the remote format. They developed memos, acted as virtual assistants, and digital volunteers for the institutes of pedagogy and Psychology, natural science and geography, history and law, and philology. The most difficult thing was for the Institutes of art, culture and sports and the military department. Of course, the main problem was the implementation of motor activity and the need to collect for orchestras, choral groups, the lack of an instrumental base, etc.

To the question:"Your adaptability to online learning? Only 9% (Abai KazNPU), 7% (M. Kh. Dulaty Taraz State University) of respondents answered perfectly; 17% (Abai KazNPU), 20% (M. Kh. Dulaty Taraz State University) answered well; 32% (Abai KazNPU), 32% (M. Kh. Dulaty Taraz State University) answered satisfactorily; 42% (Abai KazNPU), 51% (M. Kh. Dulaty Taraz State University) answered poorly.

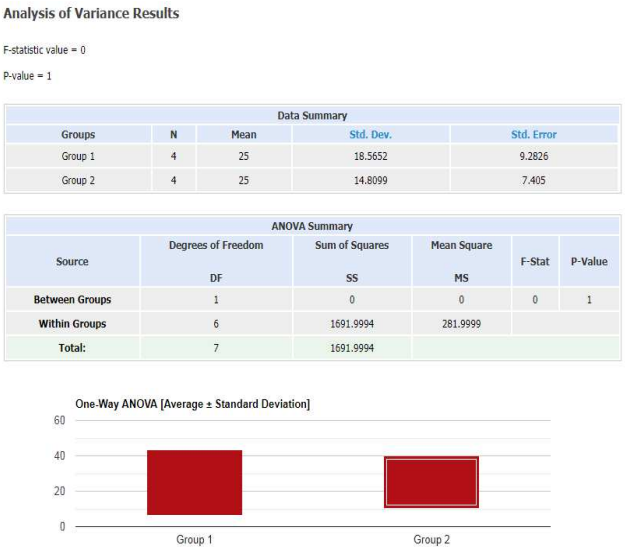

Figure 4. Analysis of variance results

It is worth noting that the results changed for the better in the autumn half of the year. So the adaptability to online learning with the result "bad" is reduced to 27%. In general, this indicates the existing problems of the teaching staff in technical and moral aspects. So the teacher of the older generation notes: "I immediately get lost. I don't know what to do, where to click when the Internet is turned off or when switching from one program to another, when the main window of work is lost".

The level of students' motivation to study at both universities in the framework of distance learning in the 2019-2020 academic year was 49% lower than in the autumn half of 2020-2021 - 71%, this is due to the low level of knowledge of the information competence of teachers.

Satisfaction with the process of teaching remotely: rather no than yes more than 40% (Abai KazNPU) 62% in the M. Kh. Dulaty Taraz State University.

The main remote tools used by teachers of the M. Kh. Dulaty Taraz State University when organizing and conducting classes: Zoom. At Abai KazNPU, this spectrum is wider: Zoom, Microsoft Teams, Google Class, Kahoot, Lingualeo, etc. Further development of the programs of these platforms is being strengthened.

To the question: "Did you use any online educational resources in your classes before the introduction of restrictive measures?». There were single responses of using the Google Classroom, Kahoot, Lingualeo, Whiteboard, Miro platforms in the teaching process. Teachers of the Institute of Mathematics, Physics and Computer Science used these platforms, only within the framework of the development of educational programs, introducing students to them.

I would like to note at the present time the degree of ease of use of new studies in the univer system, for example, the center for distance learning of Abai KazNPU was noted by more than 78% of teachers. At M. Kh. Dulaty Taraz State University, PLATONUS is used, but only 49% of teachers were satisfied with this automated information system.

Certainly, the students themselves probably would also have noted an increase in the academic load, however, the load of teaching staff during the quarantine period was actually increased several times. The lecture was preceded by a large preparatory work-this is the preparation of a large volume of materials, tasks, tests. This is how we created channels on the platform Youtube.com, presentations, recorded online lectures using the Camtasia Studio 8 program, filled in the content of Kahoot. The organization of feedback required, accordingly, the verification of a large volume of completed works of students. But what to hide, there were teachers who did not know how to demonstrate the screen in Zoom during the lecture.

Of course, speaking about the difficulties of this period, it is worth noting the main thing, without which it is impossible to organize online training – this is a high-

quality high-speed Internet. The main problem of our students was finding them in remote regions of our country. Problems with the Internet due to network congestion due to untimely completion of homework by students. Currently, the messengers Viber, WhatsApp, Facebook, Telegram Web, e-mail, and others are additionally used.

V. CONCLUSION

The role of information technologies based on artificial intelligence in the period of the pandemic has demonstrated its extreme relevance. Undoubtedly, artificial intelligence is becoming a full-fledged participant in the educational process and occupies a central place in the process of intellectualization of society and the development of the education system as a whole. Their wide use in various spheres of human activity dictates the expediency of getting acquainted with them as soon as possible, starting from the early stages of learning and cognition. We teachers, actively developed and implemented “Robotics” and methods of teaching it in kindergartens and schools, and we were not ready enough to meet with artificial intelligence in the conditions of distance learning. It is impossible to stop the progress and technological effectiveness of this process, so the Abai KazNPU decided to develop and introduce the elective discipline “Artificial Intelligence” at the bachelor's and master's level from the 2020-2021 academic year, with the continuity of the formed competencies, the main task of which will be to improve the skills in artificial intelligence.

REFERENCES

[1] Questions and Answers on Death and Dying: A Memoir of Living and Dying, Macmillan, 1976. ISBN 0-02-567120-0.

[2] Kiselev G.M. Information technologies in pedagogical education: a textbook for bachelors / G.M. Kiselev, R.V. Bochkova. - M.: Dashkov and K, 2016. - 304 p.

[3] Fedotova E.L. Information technologies in science and education: a textbook / E.L. Fedotova, A.A. Fedotov. - M.: Forum, 2018. - 256 p.

[4] M.I. Isaev and R.G. Novikov RECONSTRUCTION OF A POTENTIAL FROM THE IMPEDANCE BOUNDARY MAP Eurasian journal of mathematical and computer applications ISSN 2306-6172 (p); ISSN 2308-9822 (o) Volume 1, Number 1 (2013) 5 - 28.

[5] A.V. Nicenko A "BY PART" METHOD OF RUSSIAN WORD SPEECH RECOGNITION Eurasian journal of mathematical and computer applications ISSN 23066172 Volume 1, Issue 2(2013) 102-109.

[6] Syzdykbayeva A.D., Mambetalina A.,Nuradinov A.,Kurmanbekova A., Kabylbekova Z. Collaborative environment as a means of forming success of a future teacher of elementary classes in project activity Journal of Intellectual Disability - Diagnosis and Treatment, Volume 8, No.3, 2020, pp. 370-376.

[7] D. Tatar, J. Roschelle, P. Vahey, W.R. Penuel Handhelds go to school: Lessons learned Computer (9), 2003.- pp.30-37.

[8] N.T. Heffernan,C.L. Heffernan ASSISTments Ecosystem: Building a platform that brings scientists and teachers together for minimally invasive research on human learning and teaching International Journal of Artificial Intelligence in Education, 24 (4) (2014), pp. 470-497.

[9] N. Humble, P. Mozelius Artificial intelligence in education-a promise, a threat or a hype? European conference on the impact of artificial intelligence and robotics 2019 (ECIAIR 2019), Academic Conferences and Publishing International Limited, Oxford, UK (2019), pp.149-156.

[10] T.T. Truong INVERSION OF SOME SPHERICAL CAP RADON TRANSFORMS Eurasian journal of mathematical and computer applications ISSN 20779879 Volume 1, Number 1 (2013) 78 -102.

[11] Bruno J. Vicente, Viatcheslav I. Priimenko, and Adolfo P. Pires STREAMLINE-BASED SIMULATION OF 2-D 2-PHASE OIL DISPLACEMENT BY POLYMER SLUGS Eurasian journal of mathematical and computer applications ISSN 20779879 Volume 1, Number 1 (2013) 103-124.

[12] Xieling Chena Haoran Xieb Gwo-Jen Hwang A multi-perspective study on Artificial Intelligence in Education: grants, conferences, journals, software tools, institutions, and researchers Computers and Education: Artificial Intelligence.- Volume 1, 2020, 1000052020, 100005.- https://doi.org/10.1016/j.caeai.2020.100005.

[13] Yang S.J.H, Ogata H., Matsui T. & Chen N.-S., Human-centered artificial intelligence in education: seeing the invisible through the visible, Computers and Education: Artificial Intelligence. https://doi.org/10.1016/j.caeai.2021.100008.

[14] https://univer.kaznpu.kz/.

[15] Gwo-Jen Hwang Haoran Xie Benjamin W. Wah Dragan Gašević Vision, challenges, roles and research issues of Artificial Intelligence in Education.- Computers and Education: Artificial Intelligence, Volume 1, 2020, 100001.- https://doi.org/10.1016/j.caeai.2020.100001.

[16] Zakharova I.G. Information technologies in education: / I.G. Zakharova. - M.: Academia, 2016. - 543 p.

[17] Voronkova Yu. B. Information technologies in education / Yu.B. Voronkova. - RnD: Phoenix, 2010. - 314 p.

[18] O.H.T. Lu, A.Y.Q. Huang, Huang, S.J.H. Yang / Impact of teachers’ grading policy on the identification of at-risk students in learning analytics.- Comput. Educ., 163 (2021), 10.1016/j.compedu.2020.104109.

[19] O. Lu, A. Huang, J. Huang, A. Lin, H. Ogata, S.J.H. Yang Applying learning analytics for the early prediction of students’ academic performance in blended learning /Journal of Educational Technology & Society, 21 (2) (2018), pp. 220-232.

[20] J. Wong, M. Khalil, M. Baars, B.B.de Koning, F. Paasa Exploring sequences of learner activities in relation to self-regulated learning in a massive open online course / Comput. Educ.,140 (2019), p. 103595, 2019.

[21] A.Y.Q. Huang, O.H.T. Lu, C.J. Yin, S.J.H. Yang Predicting students’ academic performance by using educational big data and learning analytics: evaluation of classification methods and learning logs / Interact. Learn. Environ., 28 (2) (2020), pp.206-230.

[22] M., Lokhin V.M., Manko S.V., Romanov M.P. Artificial intelligence and intelligent control systems; Nauka-M., 2012. - 336 p.

[23] Kuznetsov V.V. Prospects for the development and use of chatbots in education / V.V. Kuznetsov // Uspekhi sovremennoy nauki, 2016. - Vol. 8. - No.12. - pp. 16-19.

[24] Xieling Chena Haoran Xieb Di Zouc Gwo-Jen Hwang Application and theory gaps during the rise of Artificial Intelligence in Education / Computers and Education: Artificial Intelligence.- Volume 1, 2020, 100002. https://doi.org/10.1016/j.caeai.2020.100002.

[25] Chong Guana Jian Moub Zhiying Jiang Artificial intelligence innovation in education: A twenty-year data-driven historical analysis.- International Journal of Innovation Studies.- Volume 4, Issue 4, December 2020, Pages 134-147. https://doi.org/10.1016/j.ijis.2020.09.001.

[26] Artificial intelligence: an interdisciplinary approach: ed. by D.I. Dubrovsky and V.A. Lektorsky-M.: IInteLL, 2006. - 448 p. - ISBN 5-98956-005-2.

[27] Stephen, J.H. Yang, Hiroaki Ogata,Tatsunori Matsui, Nian-Shing Chen Human-centered artificial intelligence in education: Seeing the invisible through the visible. Computers and Education: Artificial Intelligence, Volume 2, 2021, 100008, https://doi.org/10.1016/j.caeai.2021.100008.

[28] G. Kurdi, J. Leo, B. Parsia, U. Sattler, S. Al-Emari A systematic review of automatic question generation for educational purposes / Int. J. Artif. Intell. Educ., 30 (1) (2020), pp. 121-204.

[29] B. Das, M. Majumder Factual open cloze question generation for assessment of learner's knowledge / International Journal of Educational Technology in Higher Education, 14 (24) (2017), 10.1186/s41239-017-0060-3.
[30] K.B. McDermott, P.K. Agarwal, L. D'Antonio, H.L. Roediger III, M.A. McDaniel Both multiple-choice and short-answer quizzes enhance later exam performance in middle and high school classes / J. Exp. Psychol. Appl., 20 (1) (2014), p.3.
[31] T. Stenlund, A. Sundström, B. Jonsson Effects of repeated testing on short- and long-term memory performance across different test formats / Educ. Psychol., 36 (10) (2016), pp. 1710-1727, 10.1080/01443410.2014.953037