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NEURAL NETWORKS AT THE SERVICE OF EDUCATION: CHALLENGES OF THE NEW ERA OF EDUCATIONAL TRANSFORMATION

The article is devoted to the current topic of using neural networks and chatbots in education. It analyzes various functions of neural networks, such as personalization of learning, automation of task checking, creation of adaptive educational materials, as well as the capabilities of chatbots to support and motivate students.

The paper highlights the importance of using artificial intelligence (AI) in education, noting its potential to improve learning quality, accessibility and efficiency. The authors cite the pros and cons of introducing chatbots and neural networks into the educational process, citing the results of a survey and interviews with participants in the educational process (students and teachers).

Methodology included theoretical analysis of the state of development of the problem, such scientometric databases and repositories of scientific texts as: Researchgate, GoogleScholar and Scopus databases were used. Teachers (School of Psychology and School of Foreign Languages) and students (School of Psychology and School of Foreign Languages) of V. N. Karazin Kharkiv National University participated in the empirical part of the study. Data were collected using a Google form and interviews with participants in the educational process. The practical aspect of the study involved the use of two questionnaires created with Google Forms. One of them was designed for students, while the other one was tailored for teachers from V. N. Karazin Kharkiv National University and other higher education institutions. Both questionnaires comprised 12 and 11 open- and close-ended questions respectively. Also, the teacher respondents were asked 7 open questions, two of which were of a general organizational nature.

The results of the study confirm the importance and modernity of the use of AI both in the work of teachers and in teaching students. Teachers say AI is helping them automate routine tasks, personalize learning, and provide better feedback to students. Students see AI as a valuable tool for independent learning, support and motivation. The article also proposes for discussion the most important ways of developing neural networks in education, such as: the development of adaptive learning systems that can adapt to the individual characteristics of each student; deeper interaction in the teacher-neural network

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paradigm; development of infrastructure for the introduction of neural networks into the educational process; using AI to assess students' knowledge and skills, which will make the learning process more objective and transparent.

***Keywords**: neural networks, chatbots, artificial intelligence, education, personalization of learning, ways of developing neural networks.*

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Introduction. In today's world, characterized by the rapid development of technology, education is becoming a place where innovation plays an important role [15]. Contributing to ever-increasing opportunities, technology is transforming the way we think about learning by accelerating processes, optimizing resources, and increasing accessibility. In this context, neural networks, as a key component of artificial intelligence, act as an indispensable tool for the transformation of the educational process on the basis of the digital transition [16; 20; 32].

Scientific research in the field of the use of neural networks in education is becoming an important direction of academic studies [1; 4; 16], as it allows considering various aspects of the impact of these technologies on the educational process. There is a need for a deep understanding and analysis of how neural networks can optimize the learning process, providing individualization, increased efficiency and accessibility of education for a wide range of users (Fig. 1).

This study is aimed at highlighting the challenges and prospects that are opened up thanks to the application of neural networks in the field of education. The study of this topic will contribute to the understanding of the potential of neural networks in improving the educational process and determining ways to further improve this methodology in order to achieve maximum results in the field of education in the new era of transformation.

The analysis of previous studies shows that the topic of the introduction of neural networks in the educational process has a fairly clear tendency to grow, especially this dynamic is monitored in the context of the exponential development of neural networks that took place at the end of 2022 and the beginning of 2023 [13; 14]. A real milestone took place in the world of digital technologies, which determines the further development of digital technologies for the next 10 years as one of the main trends and triggers of changes in all spheres of social relations [2; 14; 26].

The attention of scientists researching neural networks and their derivatives has not bypassed the educational sphere. Thus, scientists are investigating: the principles of introducing neural networks into the educational process of educational institutions [10], the didactic capabilities of neural networks [20], the diagnostic potential of neural networks [18] and the issue of academic integrity in various areas of science and learning [3; 21; 31].

In the context of the study, we consider the scientific achievements of scientists [6] regarding the use of neural network the educational process

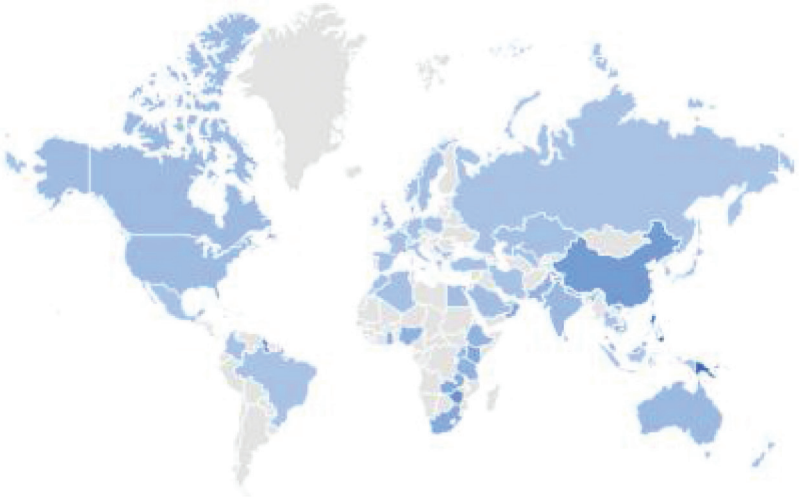


***Fig. 1.** Popularity of the search query «AI in education» by region [8]*

of higher education institutions to be particularly interesting. In times of new challenges and overcoming educational losses caused by the COVID-19 pandemic [15], the educational community is looking for new ways to use digital technologies, and the revolution that took place in 2023 in the field of digital technologies provides many ways to improve and improve educational and administrative processes in institutions of higher education, and clearly outlines the challenges that await education in the near future [5]. This is a press for all issues of academic integrity and the creation of educational content by students and teachers.

The purpose of the study is to analyze the place of neural networks in the educational activities of the participants of the educational process (students and teachers) and the prospects of their rational application for the benefit of educational development.

Methodology. Various theoretical, analytical and empirical methods were used in the research, which are aimed at collecting, processing and analyzing information and data regarding the use of neural networks by participants in the educational process (students and teachers). For the theoretical analysis of the state of development of the problem, such scientometric databases and repositories of scientific texts as: Researchgate, GoogleScholar and Scopus databases were used. Teachers (School of Psychology and School of Foreign Languages) and students (School of Psychology and School of Foreign Languages) of V. N. Karazin Kharkiv National University participated in the empirical part of the study. Data were collected using a Google form and interviews with participants in the educational process. The practical aspect of the study involved the use of two questionnaires created with Google Forms. One of them was designed for students, while the other one was tailored for teachers from V. N. Karazin Kharkiv National University and other higher education institutions. Both questionnaires comprised 12 and 11 open- and close-ended questions respectively. Also, the teacher respondents were asked 7 open questions, two of which were of a general organizational nature.

Results. The efficiency of the higher education institution depends on various factors, one of which is the quality and quick interaction among participants in the educational process. It was previously believed that such communication should take place directly, in person. However, recently, the level of informatization and digitalization in the field of education has significantly increased [14; 16; 20].

In essence, the most effective path ahead involves integrating AI into the educational framework and utilizing its potential to enhance learning outcomes for students. To contribute to the discussion on the best ways to use AI, this paper explores both its possible advantages and risks (Fig. 2.) [13].

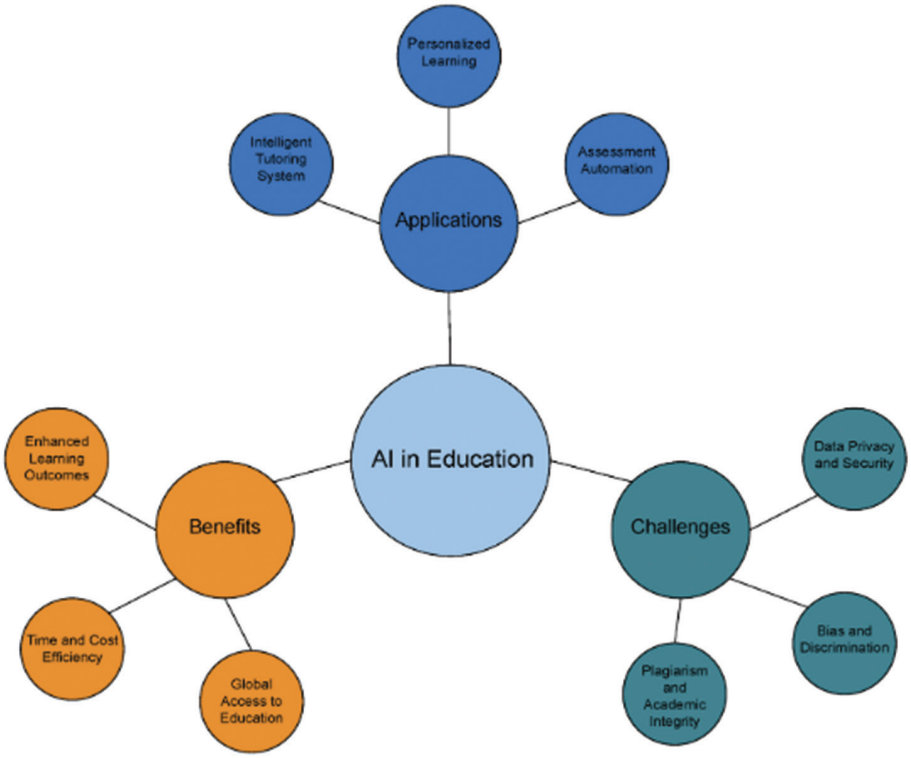


Fig. 2. *Multifaceted impact of AI in education [13]*

After conducting a series of studies [5; 10; 19; 24], reviewing scientific literature, and conducting surveys, we have identified the main advantages and disadvantages of using chatbots and artificial neural networks (ANNs) in education.

Types of chatbots:

1. Menu or Button-Based Chatbots. This type of chatbot is typically presented in the form of buttons or top-down menus and follows the principle of decision tree. Users are guided to make decisions by selecting options to eventually reach the appropriate response from the AI. While this is the most commonly used and the simplest type of chatbots, it may be comparatively slower in terms of performance.

2. Keyword Recognition-Based Chatbots. This type of chatbot operates by recognizing specific keywords to generate the desired result. It tailors its responses in accordance with what the users enter. Using AI technology and a customized keywords list, such chatbots use algorithms to determine an appropriate response. However, they may encounter challenges when there are keyword surfeits between several analogous questions.

3. Contextual Chatbots. These chatbots are currently most technologically advanced bots. To interpret the user's input, this type utilizes Machine learning and AI technologies such as voice recognition, speech-to-text conversion algorithms etc. This type of chatbots analyzes the user's intentions and provides profound answers by deciphering patterns in the database. These chatbots develop over time as they encounter more experiences, enhancing their ability to understand and respond to users.

Types of ANNs:

There are several types of neural networks that differ in their learning algorithms and architecture:

1. Feedforward Neural Network (FNN). This is the most common and simplest type of neural network. FNNs consist of an input layer, one or more hidden layers, and an output layer. Data pass from the input layer through the hidden layers to obtain the final result. This type of neural network is mostly used for regression, classification, and pattern recognition.

2. Convolutional Neural Network (CNN). This type of neural network is used for the analysis and processing of images. It employs convolutional layers by extracting features from input data and combining layers to reduce the sampling of feature maps. CNNs are used for image classification and object detection. They can also recognize data patterns.

3. Recurrent Neural Network (RNN). This type of neural network is used for processing sequential data. The network can store information over time using a directed cycle formed by connections between neurons. RNNs are employed for machine translation, speech recognition, and image captioning.

4. Generative Adversarial Networks (GANs). This type of neural network consists of a generator and a discriminator. The latter one is trained to assess the realism of the input it receives. When the generator produces synthetic samples, the discriminator determines which samples are real and which are fake. The generator's objective is not to minimize the distance to a specific image but rather to fool the discriminator. The joint training of the GANs occurs in this process. GANs are used for generating text and video, and synthesizing images.

Advantages of using chatbots and artificial neural networks (ANNs). Chatbots and ANNs offer numerous benefits that significantly facilitate the learning process. These advantages include:

1. Reliability and detail of information, as well as convenient presentation.

2. Accessibility. Utilizing ANNs and chatbots enables students to access educational programs and online courses from any location and at any time. Education costs are also reduced.

3. Ease and intuitiveness of use. Communication is simplified through conversational forms or button selections, and users are given the option to choose a communication channel that is convenient for them.

4. Personalization of learning. It is possible to generate personalized training programs for every student by analyzing their data.

5. Absence of psychological and emotional pressure on the user. The lack of punishment for incorrect answers encourages students to respond more freely to questions and seek information.

6. Automated assessment. Achieving automated assessment of tests and other assignments saves teachers time, allowing them to focus on other activities. This automated knowledge assessment process ensures objectivity, reliability, and the ability to provide feedback and predict student success.

7. Optimization of learning. There is the possibility to improve educational programs and teaching methods through their optimization. They can help determine the most optimal level of task difficulty for each student.

8. Enhancement of understanding. By using ANNs and chatbots to analyze a large amount of

data, educators can improve their understanding of the most effective teaching methods and strategies.

9. Encouragement of students to learn.

10. Multimedia capabilities. The inclusion of videos, audio, tables, images, and file documents in textual explanations is possible. To provide students with course materials, voice assistants can use voice messages from instructors for consultation instead of distributing the material.

11. Data analysis and digitization.

12. Ability to quickly contact educational institutions. Moreover, chatbots and ANNs can collect feedback from users through a dialogue interface.

13. Data confidentiality.

Disadvantages of using chatbots and artificial neural networks (ANNs). Despite all the advantages, there are also several drawbacks that should be considered in the field of education. These disadvantages include:

1. Diversity of messengers on which the bot needs to be deployed, caused by the absence of network versions of certain ready-made programs.

2. Absence of group activities. Cooperation among students and other group members is limited.

3. Need for a large amount of data. ANNs and chatbots need a substantial amount of data to learn effectively. Without a sufficient volume of data, the model's performance may not be optimal.

4. Low data quality. There can be errors and inaccuracies, leading to incorrect results.

5. Low reliability. Chatbots and ANNs can be targeted by harmful software, which can put their security and dependability at risk.

6. High complexity. Training chatbots and artificial neural networks is a very complex process that requires a substantial amount of resources and time.

7. Incorrect answers. Responses can be incorrect in certain situations, providing inadequate answers to complex tasks that require deeper understanding.

8. Ethical issues. Neural networks may collect data about students, violating their security and privacy.

9. Technical dependence. To ensure the operation of chatbots and ANNs, technical infrastructure is used, which can be challenging to maintain.

10. Lack of flexibility.

11. Possible loss of self-learning skills.

12. Low preparation of teachers for using chatbots and ANNs in education.

Characteristic features of chatbots and ANNs:

1. Adaptive learning (this process involves monitoring the progress of individual students and alerting the instructor of any challenges faced by the student);

2. Personalized learning (one can choose their level of learning, speed, and complexity);

3. Automatic assessment (based on responses, it automatically evaluates and assigns grades);

4. Interval learning (gradual reinforcement of learning material);

5. Evaluation of teachers by students (it is based on student surveys, and their attitudes towards teachers are identified, providing a basis for obtaining relevant information and adjusting actions).

Main trends in the use of chatbots and ANNs in education:

1. Personalized learning: Chatbots and ANNs contribute to the development of personalized learning programs that consider the individual needs and abilities of each student, increasing the educational process's effectiveness. This includes determining the most optimal level of task complexity for students and automatically adjusting it. For example, increasing the difficulty of tasks for students who demonstrate a high level of knowledge can enhance their skills. On the other hand, personalized learning can provide additional support to students struggling to understand the material. An individualized approach also helps students with significant differences in previous knowledge and skills. For example, those with more experience in certain fields.

2. Inclusivity: The rapid development of virtual assistants or voice-activated chatbots capable of performing tasks based on voice commands and the ability of AI to recognize voice commands increase the accessibility of education, especially for students with physical or cognitive impairments. For instance, chatbots can deliver educational material through text messages or voice assistants for students with visual or hearing impairments.

3. Automation and simplification of administrative processes: ANNs and chatbots can automate certain processes in educational institutions, such as form filling, tracking student performance, and scheduling. This can reduce the workload on teachers and administrators, saving time.

4. Accessibility of education: Using apps and online platforms with integrated AI enables students to receive quality education anywhere and anytime. This can also reduce education costs, particularly lowering expenses related to logistical issues.

5. Addressing complex issues of education quality: AI can handle «fuzzy» tasks by considering and processing multiple factors, mimicking the

workings of the brain. This can assist in evaluating the quality of students' acquired knowledge, teaching staff, the state of educational infrastructure, and the competitiveness of professionals in the job market.

6. Economic and time benefits: The automatic assessment of knowledge and skills provided by ANNs and chatbots can significantly save time for teachers and educational institutions. For example, in conducting tests for a large number of students, AI can assess more quickly and efficiently than manual grading.

7. Use of gaming and media elements to increase engagement: Chatbots incorporate gaming elements, such as tasks with varying levels of difficulty, to make learning more engaging and stimulating for students. ANNs can generate images for visual aids in educational materials, presentations, etc.

8. Providing feedback: Chatbots and ANNs facilitate feedback between students and teachers. They can help students get answers to questions about the material or the learning process, allowing teachers to track students' progress and provide feedback. If a student answers a question incorrectly in a test, the system can suggest additional tasks or reference materials to help them improve their knowledge.

9. Use of language and voice recognition technologies: Chatbots and ANNs with language and voice recognition can enable convenient and effective communication between students and teachers. This can be especially beneficial for students with writing or reading difficulties and aid in the learning of foreign languages by helping with intonation, emphasis, and tones.

10. Reducing student stress during learning and exams: For instance, the authors of the article [12] developed a pupil analysis system that helps determine how well students have mastered the educational material. The fact is that many previous studies have proven the relationship between the size of the pupil and the cognitive load of a person. This system helps avoid formal tests or exams that would cause stress for students.

11. Development of metacognitive thinking in students: Unlike asynchronous communication methods, chatbots and ANNs encourage students to express their thoughts and beliefs during discussions. Apart from that, use of chatbots during a course can reduce the disparity between computer and student assessment.

12. Cloud services and computing: There is a development of cloud computing technologies. This allows real-time data retrieval from data center services or external sources, analysis, and proposing solutions based on rules and information stored in the knowledge base. Integrating cloud technologies into the educational process can support collaborative project work, group completion of practical tasks and experiments online, and conducting online courses.

Nearest prospects for the implementation and practical application of AI in education

AI will ensure the creation of an educational system, capable of adapting to the individual needs of every student, including their learning pace, level of knowledge, interests, etc. This will help to utilize their time and resources more effectively, improve the quality of education and its accessibility. It can also enhance students' academic performance.

Likely, AI would be used for the development of new methods and approaches in education. For example, use of VR and interactive games will make this experience even more engaging and exciting for the students.

Furthermore, full automatization of certain tasks and processes can be expected, such as test checking and student assessment. Except for obvious reduction in the workload for teachers, this will provide a more unbiased evaluation of student work. Moreover, AI's ability to solve poorly structured tasks will simplify the independent learning process and broaden the range of learning tools available to participants in the educational process.

In addition, use of AI will help to solve many problems related to the quality of assessment of education. It will be capable not only of identifying these issues but also analyzing the underlying reasons and tendencies leading to them. Moreover, AI will suggest potential solutions and methods for further monitoring of these matters.

Over time, more and more chatbots will start using contextual information to enhance their productivity and personalize results. One such approach involves receiving physical contextual data of students, by analyzing their behavior on educational platforms. Another method of incorporating contextual data into chatbot responses involves capturing context. Various emotions can be recognized based on the speech and sentiment analysis of linguistic transcripts. This would provide students with more individualized learning support [9; 25].

Further development of the AI in the field of voice recognition and reproduction will assist students in mastering tonal languages like Japanese, Chinese, Vietnamese, Burmese, and Nilotic. As demonstrated in research on [7; 11; 17; 33], ANNs will be able not only to provide audio reproduction

of specific lexical units but also to transcribe them using one of the two systems. This will facilitate correct pronunciation and emphasis for students and enhance their general speaking abilities.

In the context of the logic of the study, it is necessary to analyze the answers collected during surveys and interviews with participants in the educational process (teachers and students).

Let's consider the answers received from teachers about the role and methods of using neural networks and chatbots in their work. It is important to note that all interview participants noted that they are familiar with the concept and functionality of neural networks and chat bots.

Q. 3. If so, for what purposes have you used chatbots or neural networks?

To check for academic dishonesty (N1)

Generation of textual and visual information for the educational process, organization of the educational process (N2)

For educational purposes, namely: to show students the possibilities of chatbots and neural networks and how they can be usefully used in education (N3)

Q. 4. What advantages do you see in using chatbots or neural networks for teaching purposes?

Preparation of educational materials (N3)

Artificial intelligence is a very powerful tool in the work of a higher education teacher, it greatly saves time and provides ideas for further work (N5)

Helps you quickly find information, create tasks, etc (N1)

Saving time (N6)

Q. 5. What disadvantages have you encountered when using chatbots or neural networks? (What do you think are the possible disadvantages of using chatbots/neural networks?)

Irrelevance of information (N1)

Of course, it should be noted that there are still limitations in the answers and creation of educational content, plus most neural networks and chatbots have both free and paid versions, which can sometimes limit their use. (N2)

1. When using chatbots, you need to be able to analyze the information it provides. 2. It does not generate a bibliography, rather it provides incorrect references. 3. the free version has some limitations (N3)

There is no live communication (N6)

Q. 6. What chatbots or neural networks for teaching purposes have you used? The teachers answered this question by listing various neural networks, the most common ones include: Bard, ChatGPT, Gamma, Undetectable Ai, Rask.

Q. 7. What specific features of chatbots/neural networks do you find most useful for learning and teaching?

Speed of response and multi-functionality (N1)

With the correct formulation of the question, you can get really necessary information (N4)

Focus on the target audience, saving time (N5)

The results obtained among students have their own specifics, and we will briefly describe their features. 100 percent of students who took part in the survey answered that they know what neural networks and chatbots are. To the question, «Have you ever used chatbots or neural networks for educational purposes?» Students answered in such a proportion that almost 38 percent indicated. that used either neural networks or chatbots, 21 percent indicated that they use both tools, others noted that they have not yet used their potential.

The main answers to the following question «If so, for what purposes have you used chatbots or neural networks?»: study of the material; check answers; for clarification of terms; to find an answer to a question, to sum up too long texts that there is no time to read; to talk when you are lonely; creating presentations.

The following question was sent: «What advantages do you see in the use of chatbots or neural networks for educational purposes?»: helps to study a certain topic more deeply «in plain language»; checking knowledge, obtaining additional tasks, compiling tasks (for teachers); finding more information; acceleration of time-consuming processes.

Systematization of answers to questions «What are the possible disadvantages, in your opinion, of using chatbots/neural networks?» allowed for the following responses: inaccuracy of information and lack of references to resources (even if requested to find them), copyright infringement, negative impact on content quality and academic integrity; some people may split, will not make any effort; make people think less with their heads; using them to do work that the student actually has to do on his own. It is interesting that 85.7 percent of surveyed students agree that the use of chatbots/neural networks can help students better organize their time and keep track of academic achievements The absolute majority of respondents (97%) use chatbots to create and translate texts and graphic neural networks to create presentations and video for their homework.

In general, we can conclude that neural networks and chatbots are of interest to both students and teachers. From the responses received from respondents and previous studies [2; 5; 27; 30], we want to state that the near future of education is inextricably linked with the introduction of AI technologies, which are quite significantly changing the landscape of both teaching and learning. Scientists and practitioners have yet to expand their understanding of the areas of AI implementation in education and science. But now we can confidently say that the processes of learning and interaction between teachers and students have changed significantly and continue to transform with the advent of new AI capabilities.

Discussion. The capabilities of artificial intelligence in education are very large and diverse, and in the context of the study it would be rational to determine the scope of application of AI in the educational process [3; 4; 20]. For example, GPT Mind Maps Maker for the request «Determine challenges for Neural networks at the service of education in the new era of educational transformation» gives a Mind map that presents the challenges of neural networks in education (Fig. 3).

Developing the idea of introducing the use of neural networks and chatbots, and in general AI in education, it is necessary to determine the most promising points of use of this digital technology.

1. Personalize learning, impact on student engagement, knowledge retention, and overall academic achievement.

With its personalized learning program, neural networks stand as a powerful tool in the hands of education. Capable of collating performance data from all facets of a student's life course, there are now various assessments recorded in the network, myriad assignments, and scores with a multitude that reflects different answers. In light of this kind of data, it is possible to identify an individual's strong and weak points and his preferred way of learning. Thus the network will alter its content, degree of difficulty, instructional modes, and methods according to each student's specific needs. Through continuous analysis of students' progress as they interact with study materials, neural networks may give instant feedback to the student and warn of where misunderstandings or gaps in knowledge lie. Thus the network can suggest complementary materials, specific exercises that are tailored to suit particular points of difficulty, or alternative explanations – all to bridge the gap at this stage and avoid it growing further along in time.

2. Building the correct interaction in the teacher-neural network paradigm.

The risk of excessive dependence on neural networks in education highlights the critical necessity of maintaining human oversight. While neural networks offer significant benefits in personalizing learning experiences, there are concerns regarding their limitations and potential biases. Human oversight ensures that decisions made by neural networks align with educational objectives and ethical standards [3; 21; 23].

Incorporating human judgment allows educators to interpret the recommendations provided by neural networks in the context of broader pedagogical goals. It also enables intervention in cases where the automated system may overlook crucial factors or make errors in judgment. Moreover, human oversight helps mitigate the risk of reinforcing existing inequalities or inadvertently excluding certain students from the learning process. Teachers' involvement fosters a holistic approach to education, encompassing socio-emotional aspects and values that are integral to the learning experience. While neural networks excel in data analysis and pattern recognition, they may lack the nuanced understanding and empathy essential for addressing the diverse needs of learners.

Ultimately, the symbiotic relationship between neural networks and human educators can maximize the benefits of both, ensuring that technology serves as a tool to enhance rather than replace the human element in education. By maintaining human oversight, educators can harness the potential of neural networks while upholding the fundamental principles of equity, diversity, and student-centered learning.

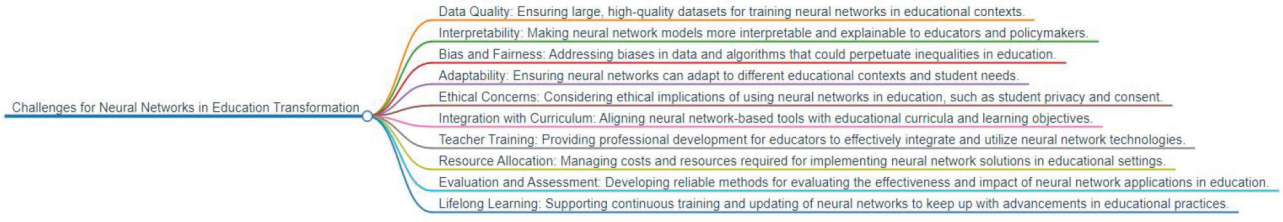


Fig.3. *Mind map (GPT Mind Maps Maker) created by AI on request:*
«Determine challenges for Neural networks at the service of education in the new era of educational transformation»

3. Need for infrastructure development and access to technology for equitable implementation.

The integration of neural networks into educational institutions faces a notable impediment in the form of insufficient technological infrastructure. This inadequacy encompasses hardware, software, and network capabilities, all of which are indispensable for the effective operation of neural network-based educational tools. The development of infrastructure for the introduction of neural networks into the educational process carries a number of risks and problematic issues. Let's look at a few of them. The efficacy of neural networks, especially those employed for complex tasks like personalized learning, is contingent upon substantial computational power. Current classroom environments often lack the requisite processing capabilities for efficient execution of these algorithms. Investment in high-performance hardware, such as Graphics Processing Units (GPUs) or specialized Tensor Processing Units (TPUs), is crucial to satisfy the computational demands of these educational tools. Educational institutions require access to suitable software frameworks for both developing and deploying neural network applications within the educational context. Custom software development tailored to specific pedagogical needs adds another layer of complexity. Furthermore, ensuring compatibility and interoperability with existing Learning Management Systems (LMS) is paramount for seamless integration into the current educational technology ecosystem. For robust operation of neural network-based educational tools, reliable high-bandwidth network connectivity is essential. Bandwidth limitations or unreliable network infrastructure can significantly impede real-time processing and delivery of personalized learning experiences. Therefore, educational institutions must prioritize investment in robust network infrastructure, encompassing high-speed internet access and appropriate network security measures.

4. The role of teachers in this new era.

The new role of the teacher will be given a central place in the new education system based on digital technologies and especially on the use of AI. A modern teacher must have developed digital competence in order to fully take advantage of new technologies in teaching students. But is it really that simple? We answer unequivocally that no. In the new paradigm of education, where the flow of information is an endless stream, the role of the teacher is transformed from a source of knowledge into its manager and expert. In this context, it is important to note that it will be difficult for one teacher to cope with the many challenges and problems that arise now, not to mention what will happen in the future, and one of the possible «assistants» could be AI, which is always ready to work and be useful in the area that the teacher can delegate [28].

An interesting experience for us is the introduction of AI into the educational process as a prompt for the teacher. For example, a teacher conducts a large lecture, or better yet, a practical lesson or control (this can be both in the classroom and online) where he physically cannot keep track and help everyone, but AI can collect data by analyzing videos or the audience about who and to what extent the work or tasks are performed, who is distracted and why. Something similar is used in the business in the context of analyzing staff engagement and visitor actions [22]. This application of AI in the educational process will help the teacher focus on the necessary aspects of learning and can act as an "always awake assistant" who will suggest which students should be paid attention to and how to help them to build their individual educational development trajectory.

Conclusion. In recent years, the popularity of chatbots and neural networks has grown significantly, and their role as part of the educational process has increased. They allow for the automation of learning and simplification of access to information for students. Increasingly, students and teachers are turning to chatbots and ANNs for help in facilitating university activities. The number of types of artificial intelligence and their functions is growing rapidly, and this is affecting the involvement of AI in the learning process.

Chatbots and neural networks have a number of advantages that improve learning and teaching. They can reduce the workload on teachers, as well as improve the quality of learning for students, through twenty-four-hour support and consultation from artificial intelligence. Most students have a positive attitude towards the involvement of chatbots and neural networks in the learning process. However, in order for technologies to become effective tools in education, it is necessary to pay attention to the development and improvement of their functionality and algorithms.

To improve the quality of the learning process, students can try to introduce chatbots and ANNs into their lives. Try to look for different variations of chatbots and neural networks, depending on the field, subject and purpose of use. In this way, you will find the optimal and most convenient artificial

intelligence for you. Use AI not only to search for information or write essays, but also to test your knowledge by generating questions or tests. In addition, save all the found material or tests that may be needed in the future to prepare for exams. If you cannot find a chatbot that suits your needs, you can create it yourself, and it may also be useful to other people. But it should be remembered that artificial intelligence will not replace human labor. A chatbot and ANNs can only become a tool for improving learning, but not a full-fledged replacement for specialists.

Prospects for further research will focus on the ethical issues of using AI in education and its impact on academic integrity. As with any technology, it's crucial to consider the ethical implications and potential biases of using neural networks in education (United Nations Educational, Scientific and Cultural Organization, 2021). Future research should explore ways to mitigate algorithmic biases, ensure fairness and transparency in decision-making processes, and promote equitable access to AI-driven educational resources for all students.

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НЕЙРОМЕРЕЖІ НА СЛУЖБІ ОСВІТИ: ВИКЛИКИ НОВОЇ ДОБИ ТРАНСФОРМАЦІЇ НАВЧАННЯ

Стаття присвячена актуальній темі використання нейромереж та чатботів в освіті. В ній аналізуються різні функції нейромереж, такі як персоналізація навчання, автоматизація перевірки завдань, створення адаптивних навчальних матеріалів, а також можливості чатботів для підтримки та мотивації здобувачів.

У роботі наголошується на важливості використання штучного інтелекту (ШІ) в освіті, відзначаючи його потенціал для підвищення якості навчання, доступності та ефективності. Автори наводять плюси та мінуси впровадження чатботів та нейромереж у освітній процес, посилаючись на результати опитування та інтерв'ю з учасниками навчального процесу (студентами та викладачами).

Методологія включала теоретичний аналіз стану розробки проблеми, використовували такі наукометричні бази та репозиторії наукових текстів як: Researchgate, GoogleScholar та Scopus. В емпіричній частині дослідження брали участь викладачі (факультету психології та факультету іноземних мов) та студенти (факультету психології та факультету іноземних мов) Харківського національного університету імені В. Н. Каразіна. Дані збирали за допомогою гугл-форми та інтерв'ю з учасниками навчального процесу. Практичний аспект дослідження передбачав використання двох анкет, створених за допомогою Google Forms. Один із них розрахований на студентів, а інший – на викладачів Харківського національного університету імені В. Н. Каразіна та інших вищих навчальних закладів. Обидві анкети складалися з 12 і 11 відкритих і закритих питань відповідно. Також респондентам-педагогам було задано 7 відкритих запитань, два з яких мали загальноорганізаційний характер.

Результати дослідження підтверджують важливість та сучасність використання ШІ як у роботі викладачів, так і у навчанні студентів. Викладачі зазначають, що ШІ допомагає їм автоматизувати рутинні завдання, персоналізувати навчання та надавати студентам якісніший зворотний зв'язок. Студенти ж бачать в ШІ цінний інструмент для самостійного навчання, отримання підтримки та мотивації. У статті також пропонуються для обговорення найважливіші шляхи розвитку нейромереж в освіті, такі як: розробка адаптивних систем навчання, здатних підлаштовуватись під індивідуальні особливості кожного учасника освітнього процесу; глибша взаємодія в парадигмі викладч-нейромережа; розвиток інфраструкти для впровадження нейромереж у навчальний процес; означення нової ролі викладача у часи цифрової трансформації та впровадження нейромерж в освітній процес закладів вищої освіти.

Ключові слова: *нейромережі, чати, штучний інтелект, освіта, персоналізація навчання, шляхи розвитку нейромереж.*

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