Zhytomyr Ivan Franko State University Journal.
Pedagogical Sciences. Vol. 3 (118)

Вісник Житомирського державного
університету імені Івана Франка.
Педагогічні науки. Вип. 3 (118)

ISSN (Print): 2663-6387
ISSN (Online): 2664-0155

UDC 378:004.8
DOI 10.35433/pedagogy.3(118).2024.14

ARTIFICIAL INTELLIGENCE IN EDUCATION: THE POTENTIAL IMPACTS AND CHALLENGES

S. M. Sytniakivska[*], O. V. Kulish[**]

The article presents a study of the influence of artificial intelligence (AI) on the educational field, namely on the use of its capabilities by students and staff of higher educational institutions, and analyzes the positive and negative effects of this use. Today, artificial intelligence is not only a reality, but has become an integral part of the educational process, as it is used by all its participants.

The study of the impact of artificial intelligence on the educational process is extremely relevant due to its wide use, because it will provide an opportunity to significantly change teaching and learning methods, ethical and social aspects, therefore understanding the impact of artificial intelligence on education has become critically important.

The purpose of the study was to analyze the impact of artificial intelligence on the academic success of students and the professional activity of teachers; identification of challenges associated with the introduction of artificial intelligence into the educational process; creating recommendations to overcome or minimize identified challenges.

The research methods were analysis, synthesis, comparison, quantitative methods (secondary data, descriptive statistics).

It was established that the implementation of artificial intelligence in education opens up significant opportunities for improving the quality of learning, teaching and increasing academic success. Both readiness and concern of the participants of the educational process for possible changes and challenges are monitored, this emphasizes the relevance and importance of further work on potential challenges regarding artificial intelligence in the educational process. The need for a more in-depth study of ethical and social problems related to the use of artificial intelligence in education has been established to ensure work on the adaptation of educational programs taking into account its capabilities.

Based on the results of the research, a list of recommendations was developed to overcome the potential challenges of using artificial intelligence in education.

We consider the study of the social consequences of the introduction of artificial intelligence in education as perspectives for further research, in particular the impact on the interaction between students and teachers, changes in the educational process and the impact on social inequality.

[*] Doctor of Sciences (Pedagogy), Full Professor
(Polissia National University)
hng@ukr.net
ORCID: 0000-0003-1367-0487
[**] Bachelor's Student Majoring in Social Work
(Zhytomyr Ivan Franko State University)
sashakulish84@gmail.com
ORCID: 0009-0005-6238-0007

Keywords: *education, artificial intelligence, challenges of using AI, chatbots, development of critical thinking, online education, personalized learning, adaptive educational platforms.*

ШТУЧНИЙ ІНТЕЛЕКТ В ОСВІТІ: ПОТЕНЦІЙНИЙ ВПЛИВ ТА ПРОБЛЕМИ

С. М. Ситняківська, О. В. Куліш

У статті представлено дослідження впливу штучного інтелекту на сферу освіти, а саме на використання його можливостей як студентами, так і викладачами закладів вищої освіти та проаналізовані позитивні і негативні впливи цього використання. Сьогодні штучний інтелект є не лише реальністю, але став невід'ємною частиною навчального процесу, оскільки використовується усіма його учасниками.

Вивчення впливу штучного інтелекту на освітній процес є вкрай актуальним через його широке використання, адже це дасть можливість суттєво змінити методи викладання та навчання, етичні та соціальні аспекти, тому розуміння впливу штучного інтелекту на освіту стало критично важливим.

Ціллю дослідження був аналіз впливу штучного інтелекту на академічну успішність студентів та професійну діяльність викладачів; ідентифікація викликів, що пов'язані з впровадженням штучного інтелекту в освітній процес; створення рекомендацій для подолання або мінімізації виявлених викликів.

Методами дослідження були аналіз, синтез, порівняння, кількісні методи (вторинні данні, описова статистика).

Було встановлено, що впровадження штучного інтелекту в освіту відкриває значні можливості для покращення якості навчання, викладання та підвищення академічної успішності. Відстежується, як готовність, так і занепокоєння учасників освітнього процесу до можливих змін та викликів, це підкреслює актуальність та важливість подальшої роботи над потенційними викликами щодо штучного інтелекту в освітньому процесі. Встановлено необхідність більш глибоко вивчення етичних та соціальних проблем, пов'язаних із використанням штучного інтелекту в освіті для забезпечення роботи над адаптацією навчальних програм з урахуванням його можливостей.

За результатами дослідження було розроблено перелік рекомендацій для подолання потенційно можливих викликів використання штучного інтелекту в освіті.

Перспективами подальших досліджень вважаємо вивчення соціальних наслідків впровадження штучного інтелекту в освіту, зокрема вплив на взаємодію між здобувачами освіти та викладачами, зміни в навчальному процесі та вплив на суспільну нерівність.

Ключові слова: *освіта, штучний інтелект, виклики використання ШІ, чатботи, розвиток критичного мислення, онлайн освіта, персоналізоване навчання, адаптивні освітні платформи.*

Introduction of the issue. The development and implementation of the latest technologies have a significant impact on our lives, and therefore, in the modern world, there are different opinions about the progress that cannot be ignored. Artificial Intelligence, like education, is one of the components of human development, although until recently, AI (Artificial Intelligence) existed only in science fiction, myths and rumours, describing robots that acted like us, but without emotions. Today, AI is a reality and is increasingly becoming an integral part of businesses, households, and even some educational institutions. This makes it necessary to study the impact of AI on the educational process and consider potential challenges in the teaching and learning environment in order to better prepare for the possible changes, ensure effective implementation of technologies and get the most positive results from all participants in the educational process.

The relevance of the topic of Artificial Intelligence is gaining popularity and is one of the most important topics for discussion. Stanford University's centennial AI study (also known as AI100) highlights some of the main aspects of the reports that confirm the

growing popularity: the number of articles on AI has increased 20-fold between 2010 and 2019 to approximately 20,000 per year; the number of students on courses has increased 16-fold internationally from a 2010 baseline, with AI being the most popular specialisation in computer science; and attendance at the Neur IPS (Neural Information Processing Systems Conference) has increased 800% since 2012 to 13,500 attendees. Other conferences show an annual growth rate of about 30% [1].

The study of AI's impact on the educational process is more relevant than ever due to its widespread implementation in various fields (including educational institutions), the ability to significantly change teaching and learning methods, and ethical and social aspects. Therefore, understanding the impact of AI on education is becoming critically important.

Current state of the issue. Currently, the topic of studying the potential impact and challenges of AI in the teaching and learning environment is to some extent covered in the research of industry leaders in education, technology, psychology, business, law, political science, and others. Researchers from Stanford paid considerable attention to the exchange of advanced research and brainstorming at the AI+Education summit. University researchers, students, and industry leaders discussed both the potential of AI to improve education and possible risks.

Percy Liang, Dora Demszky, Sal Khan, Ran Liu, Emma Brunskill, Bryan Brown, Erik Brynjolfsson, and Candace Thille pointed out the possibility of a large-scale increase in personalised support for teachers: AI can create support to improve teachers' skills by simulating students; providing feedback after teaching: AI can create reports on the dynamics of classroom performance; help teachers keep up with the latest developments in their field: AI can inform about the latest research breakthroughs or help update the curriculum; improve the quality of learning and assessment: AI has the potential to support teachers by creating unique dialogue options for each student and the ability to quickly identify student skills. The researchers also pointed to the prospects for important changes for students, such as increased self-confidence and soft skills. However, there are also risks, which were presented by Sarah Levine, Percy Liang, Noah Goodman and Chris Piech. In their report, they noted that the results of AI work, for example, in chatbots such as ChatGPT, do not reflect true cultural diversity; are not optimised for work, as models provide answers as quickly as possible, which is not pedagogically appropriate; incorrect answers in the form of excellent design, as AI can create coherent text that is completely wrong; advanced technologies can exacerbate the crisis of motivation by affecting employment prospects. The researchers concluded that the full impact of AI on the educational process remains unclear [2].

Also worth noting is a report by the World Economic Forum, which outlines the potential for AI to revolutionise education and make it more accessible and effective for all students. The report highlights the following: the potential for AI to automate many of the tasks currently performed by teachers, such as assessment and lesson planning, which could free up teachers' time so they can focus more on interacting with students and providing them with personalised support; the use of AI to personalise learning for each student, for example, AI could be used to create individualised learning plans or to adapt learning materials to the needs of each student; the ability to inform teachers about how their students are learning However, the report also notes that there are many potential risks associated with the use of AI in education, such as bias in AI algorithms and the possibility of teachers losing their jobs. It emphasises the importance of considering these risks before introducing AI in educational institutions [3].

Others shared their thoughts:

OpenAI representative Niko Felix, who said: "We believe that educational policy experts should decide what works best for their districts and schools when it comes to the use of new technology. We are engaging with educators across the country to inform them of ChatGPT's capabilities. This is an important conversation to have so that they are aware of the potential benefits and misuse of AI, and so they understand how they might apply it to their classrooms" [4].

Richard Culatta, CEO of the International Society for Technology in Education (ISTE), a non-profit organisation that advocates the use of technology in education, emphasises the following: "We need to be asking what we need to do to prepare young people – learners – for a future world that's not that far in the future" [4].

Noam Chomsky, a professor of linguistics at the University of Arizona and professor emeritus of linguistics at the Massachusetts Institute of Technology, who opposes the use of AI in scientific activities, notes the following: "The human mind is not, like ChatGPT and its ilk, a lumbering statistical engine for pattern matching, gorging on hundreds of terabytes of data and extrapolating the most likely conversational response or most probable answer to a scientific question. On the contrary, the human mind is a surprisingly efficient and even elegant system that operates with small amounts of information; it seeks not to infer brute correlations among data points but to create explanations" [5].

There is a tendency for teachers to think, research, and discuss how AI can change education and whether it will contribute to its development. Victor Lee, Associate Professor of Pedagogy and lecturer at the accelerator initiative on generative AI in education, emphasises the importance of the role of educators in the use of AI technologies: "If we want generative AI to meaningfully improve education", he says, "there is the obvious step we need to take of listening to the existing expertise in education — from educators, parents, students, and scholars who have spent years studying education — and using what we learn to find the most pertinent and valuable use cases for generative AI in a very complicated educational system" [6].

The aim of the research is to analyse the impact of AI on students' academic performance and teachers' professional activities; identify challenges related to the introduction of AI in the educational process; and create recommendations for overcoming or minimising the identified challenges.

Research methods: analysis, synthesis, comparison, quantitative methods (secondary data, descriptive statistics).

Results and discussion. Using quantitative research methods, an analysis was carried out and conclusions were drawn based on the results of a survey among participants in the educational process of Ukrainian higher education institutions (HEIs) and secondary data to determine the impact of AI on students' academic performance and professional activities of teachers. The survey, which was conducted from 3 March to 21 May 2024, involved 50 students of various bachelor's, master's, postgraduate of various faculties, aged 17 to 35, and 32 teachers of various faculties, aged 31 to 70. Informed consent, confidentiality, and anonymity of all respondents were ensured.

To create the results, a survey was conducted among students on the use of AI-based tools or programmes in education. The answer rate "Yes" was 100% (50 respondents), "No" – 0% (0 respondents). This result is likely due to the frenzied popularisation because of the so-called "AI boom" and such aspects as the modernity and innovation of the technology. Some respondents provided detailed answers, arguing for the use of AI in education due to the significant speed of search, the ability to consider the information from a different angle, ease of access, flexibility, variability and new opportunities for research.

Students also indicated the tools and applications they usually use for learning

(Fig. 1), and respondents were given the opportunity to choose several options. According to the results, the most popular response option was ChatGPT and other chatbots – 90% (45 respondents); Grammarly and other text checking tools – 46% (23 respondents); speech recognition software (e.g. Google Voice) - 36% (18 respondents); Adaptive learning platforms (e.g. Khan Academy) – 12% (6 respondents); image and reference generation software (e.g. DALL-E) – 6% (3 respondents); text translation software (e.g. DeepL) – 2% (1 respondent). Such popularity of chatbots is due to the ability to generate answers for theoretical and creative tasks, as they are the main components of the student's educational process. In addition to the above, the respondents told us how often they use these platforms: daily – 24% (10 respondents), several times a week – 48% (24 respondents), several times a month – 12% (6 respondents), rarely – 16% (8 respondents), almost never – 4% (2 respondents). Based on the descriptive statistics of the survey, students aged 17 to 22 are more likely to use AI. When assessing the overall impact of AI, respondents indicated that their academic performance had improved somewhat (62%, 31 respondents), significantly improved (24%, 12 respondents), or remained unchanged (14%, 7 respondents).

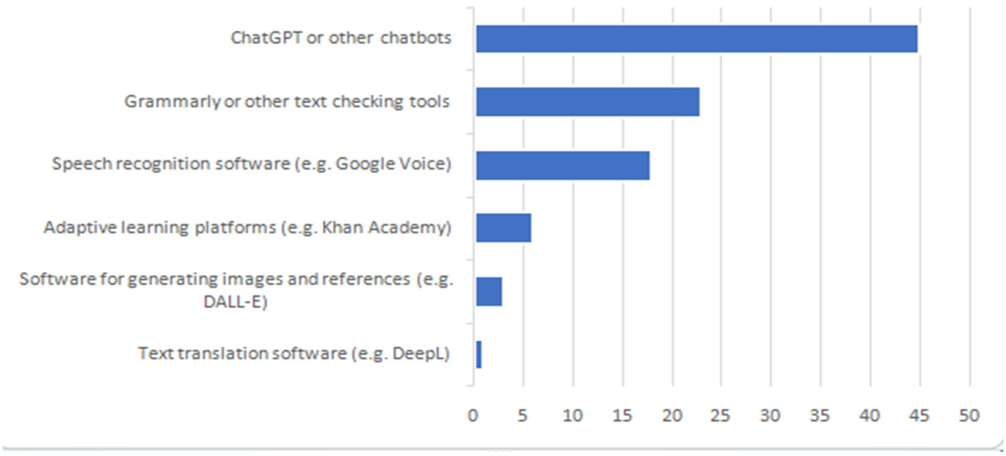

Fig. 1. Programs and tools used by students

Compared to the results of the US survey conducted by PureSpectrum, 56% said they had used AI for assignments or exams, 41% did not, and 4% abstained from answering. However, the majority of students (54%) believe that using artificial intelligence for school assignments or exams is considered cheating or plagiarism, while approximately 21% say that using artificial intelligence for assignments or exams is not cheating or plagiarism, and 25% of students remain neutral. The survey, which was conducted from 29 September to 5 October 2023, involved 1,000 US students enrolled in an on-campus, online or hybrid bachelor's or master's degree programme, with respondents aged 17-49 [7].

However, the results of Ukrainian teachers are not as clear as those of students. When asked about the use of artificial intelligence (AI)-based tools or programs in their professional activities, the "Yes" rate was 75% (24 respondents), which was justified by the simplification of certain processes and the development of readiness to use the latest technologies, and the "No" rate was 25% (8 respondents), which was justified by the beliefs of replacing the human factor, academic dishonesty, and user degradation.

Teachers who use AI in their professional activities were also given the opportunity to select several options to determine which tools and programmes they use (Fig. 2). ChatGPT and other chatbots with 54% (13 respondents), and Grammarly and other text checking tools with 54% (13 respondents) were tied for first place. Image and reference

generation software (e.g. DALL-E) came in second place with 25% (6 respondents). Adaptive learning platforms (e.g. Khan Academy) are in third with 17% (4 respondents), and in fourth place speech recognition software (e.g. Google Voice) with 12% (3 respondents). Compared to students, teachers use these platforms much less frequently: 58% (14 respondents) several times a month, 25% (6 respondents) use them rarely, and 17% (4 respondents) several times a week. Teachers assess the impact of AI on teaching as somewhat improved (79%, 19 respondents) and unchanged (21%, 5 respondents).

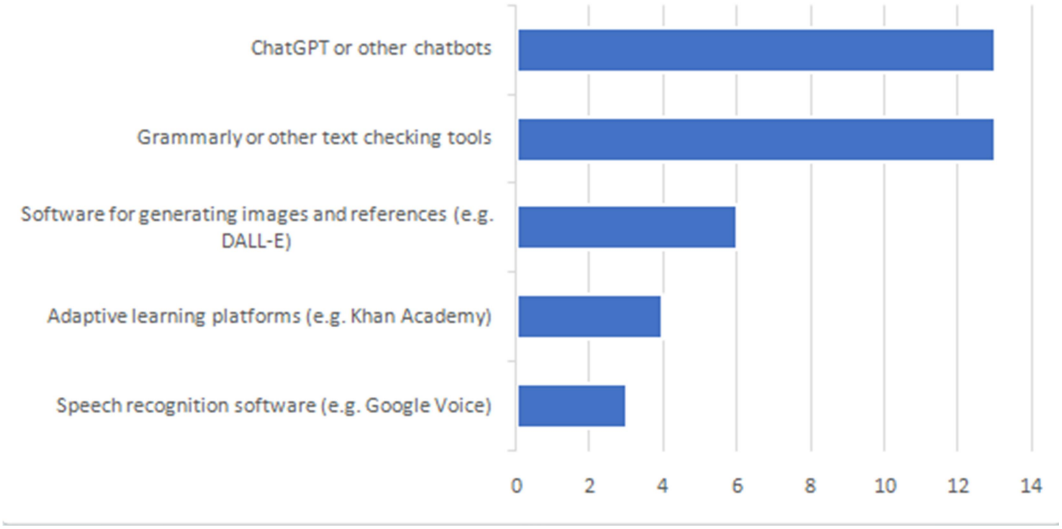

Fig. 2. Programs and tools used by teachers

However, despite the rather positive results, the majority of respondents are concerned about the emergence of possible challenges in the teaching and learning environment. It is observed that, in general, teachers and students are concerned about ethical and social issues. Based on the answers of all six ten respondents, descriptive statistics with potentially possible challenges were created, and an opportunity was given to choose several options (Fig. 3).

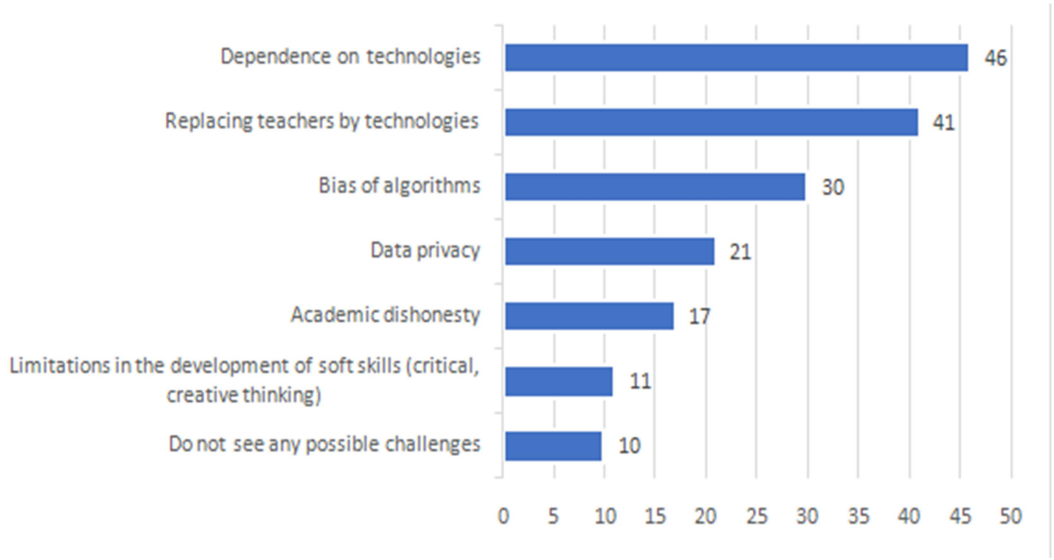

Fig. 3. Potential challenges in the learning and teaching environment as perceived by teachers and students

It should also be noted that among students, the most popular potential challenge was dependence on technologies (54%, 27 respondents),

while one in five (20%, 10 respondents) did not see any possible challenges at all. Among teachers, the most popular potential challenge was the replacement of teachers by technologies (81%, 26 respondents).

Having analysed the order of the Cabinet of Ministers of Ukraine "On Approval of the Concept of Artificial Intelligence Development in Ukraine" [8] and the final document of the international conference on artificial intelligence and education "Planning education in the AI era: Lead the leap" [9], the main directions aimed at overcoming possible challenges and the role of these documents are identified. In order to ensure the positive impact of AI on teaching and learning, the concept aims to: integrate AI into various fields, including education; improve the quality of the educational process using AI technologies; and develop digital skills. The main principles of the concept are compliance with ethical standards, privacy protection, and promotion of innovation and research. The role of this concept is to formulate public policy and create effective mechanisms for introducing AI into curricula, professional development of teachers, creating start-ups, and supporting research in the field of AI. And the recommendations of the final document of the international conference on artificial intelligence and education are aimed at integrating AI into educational systems, promoting inclusiveness and ensuring the ethical use of technology at the international level. The key recommendations for UNESCO member governments are:

AI planning in education policy;

The use of AI in education and its management;

AI in teaching and teacher empowerment;

Using AI in learning and assessment;

Promoting equitable and inclusive use of AI in education;

Gender equality in the field of AI;

Ethical, transparent and accountable use of data and algorithms;

Monitoring, evaluation and research;

Funding, partnerships and international cooperation.

The role of this UNESCO document is to create an AI for Education platform, develop guidelines to support the effective use of AI in education, and support teacher training in AI. It should also be noted that the document is recommended for consideration by governments in accordance with their national policies and legislation.

Based on the results of the research, a list of recommendations was created to overcome potential challenges:

Review AI policies based on national and international documents;

Revise or establish mechanisms and programmes for quality control, confidentiality, ethics and equity in the use of AI in teaching and learning;

Introduce courses or lectures on AI into the curriculum;

Develop a set of rules and consequences for violating them regarding the use of AI;

Ensure restrictions on creative and practical tasks;

Provide technical support through investment in AI;

Develop backup plans in case of technical failures;

Create adaptive interfaces that take into account the needs of different users;

Develop programmes to train and adapt teachers to new technologies;

Provide professional development for teachers on the use of AI in teaching;

Conduct regular surveys and research for teachers and students to monitor the effectiveness of AI use;

Involve teachers and students in the process of developing and implementing AI in education;

Ensure effective cooperation between departments of different levels.

Conclusions and research perspectives. The research has shown that the introduction of AI in education opens up significant opportunities to improve the quality of learning, teaching and academic performance. Both the readiness and concerns of educational process participants for possible changes and challenges are monitored, which

emphasises the relevance and importance of further work on potential challenges to AI in the educational process. There is a need to study more deeply the ethical and social issues related to the use of AI in education to ensure that curricula are adapted to take into account the capabilities of AI. To achieve positive results, research should continue to be conducted to create more personalised learning and increase the efficiency of the educational process.

It is planned to pay special attention to a detailed study of biases that may be present in AI algorithms. This will include an analysis of cases of discrimination based on gender, race, socio-economic status and other factors. No less important is the study of the social consequences of the introduction of AI in education, in particular the impact on the interaction between students and teachers, changes in the educational process and the impact on social inequality.

REFERENCES (TRANSLATED & TRANSLITERATED)

1. Russell, Stuart, J., & Norvig, Peter. (2021). *Artificial Intelligence*: *A Modern Approach* (4th ed.). Print [in English].
2. Claire, Chen. (March 9, 2023). *AI Will Transform Teaching and Learning. Let's Get it Right.* Retrieved from: https://hai.stanford.edu/news/ai-will-transform-teaching-and-learning-lets-get-it-right [in English].
3. Tanya, Milberg. (April 28, 2024). *The future of learning: How AI is revolutionizing education 4.0.* Retrieved from: https://www.weforum.org/agenda/2024/04/future-learning-ai-revolutionizing-education-4-0/ [in English].
4. Will Douglas Heavenarchive. (April 6, 2023). *ChatGPT is going to change education, not destroy it.* Retrieved from: https://www.technologyreview.com/2023/04/06/1071059/chatgpt-change-not-destroy-education-openai/ [in English].
5. Ruru, Kuo. (March 8, 2023). *Noam Chomsky: The False Promise of ChatGPT.* Retrieved from: https://www.nytimes.com/2023/03/08/opinion/noam-chomsky-chatgpt-ai.html [in English].
6. *Stanford faculty weigh in on ChatGPT's shake-up in education.* (December 20, 2022). Retrieved from: https://ed.stanford.edu/news/stanford-faculty-weigh-new-ai-chatbot-s-shake-learning-and-teaching [in English].
7. Jane, Nam. (November 22, 2023). *56% of College Students Have Used AI on Assignments or Exams.* Retrieved from: https://www.bestcolleges.com/research/most-college-students-have-used-ai-survey/ [in English].
8. *Cabinet of Ministers of Ukraine; Order on Approval of the Concept of Artificial Intelligence Development in Ukraine* (No. 1787-p of 29.12.2021). Retrieved from: https://zakon.rada.gov.ua/laws/show/1556-2020-%D1%80#Textlaws/show/1556-2020-%D1%80#Text [in English].
9. UNESKO. (2019). *Beijing Consensus on Artificial Intelligence and Education.* Retrieved from: https://unesdoc.unesco.org/ark:/48223/pf0000368303 [in English].

Received: August 22, 2024
Accepted: September 10, 2024