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Optimization of the educational process through the use of artificial intelligence in teachers' work

Optimización del proceso educativo mediante el uso de la inteligencia artificial en el trabajo de los profesores

Olha Tretiak
https://orcid.org/0000-0002-1160-055X
olhaperesada86@gmail.com
PhD in Pedagogy, Borys Grinchenko Kyiv Metropolitan University, Kyiv, Ukraine.
Halyna Smolnykova
https://orcid.org/0000-0001-5853-146X
H.smolnykova02@kubg.edu.ua
Associate Professor, Department of Methodology and Psychology, Preschool and Primary Education, Borys Grinchenko Kyiv Metropolitan University, Kyiv, Ukraine.
Yuliia Fedorova
https://orcid.org/0000-0002-8106-6962
Koippo41406@gmail.com
Specialization in "Practical Psychologist in the Education System" Municipal Institution «Kirovograd Regional In-Service Teacher Training Institute named after Vasyl Sukhomlynskyi», Kropyvnytskyi, Ukraine.
Yaroslav Yakunin
https://orcid.org/0000-0001-5421-0546
Y.yakunin13@kubg.edu.ua
Postgraduate education, Borys Grinchenko Kyiv Metropolitan University, Kyiv, Ukraine.
Maryna Shopina
https://orcid.org/0000-0002-1637-3480
M.shopina11@kubg.edu.ua
PhD in Psychology, Professor (Assistant), Borys Grinchenko Kyiv Metropolitan University, Kyiv, Ukraine.

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Abstract

The integration of artificial intelligence (AI) into the education sector opens up new opportunities for transforming educational processes, rethinking traditional teaching methods and implementing effective changes in approaches to learning. The aim of the article is to study the functional capabilities of AI to optimize the work of teachers of higher educational institutions (HEIs) and increase its efficiency. The research was conducted using empirical methods such as experiment, observation, and questionnaire survey. The model of integration of AI tools into the educational process was proposed and tested. The results of the study showed that the functions of AI have a powerful potential for improving the teacher's work in the context of optimization of educational processes and increasing their effectiveness in general, which was confirmed by 98% of the surveyed respondents. The ranking of promising areas of application of AI-based solutions was headed by the implementation of adaptive learning strategies (4.868 points), followed by feedback and evaluation (4.507 points), the generation of educational content ranked third (4.258 points), the management of educational activities ranked fourth (4.139 points), interaction and communication ranked fifth (3.910 points). The article may be useful for teachers interested in improving pedagogical effects through innovative digital

solutions. Research prospects may be the study of the impact of AI tools on improving the learning effectiveness of postgraduate students, as well as on the level of their learning motivation.

Keywords: Optimization of the teacher's work, management of the educational process, artificial intelligence (AI), adaptive learning, learning strategies, interactive educational environment.

Resumen

La integración de la inteligencia artificial (IA) en el sector educativo abre nuevas oportunidades para transformar los procesos educativos, replantear los métodos tradicionales de enseñanza y aplicar cambios eficaces en los enfoques del aprendizaje. El objetivo del artículo es estudiar las capacidades funcionales de la IA para optimizar el trabajo de los profesores de instituciones de enseñanza superior (IES) y aumentar su eficiencia. La investigación se llevó a cabo utilizando métodos empíricos como la experimentación, la observación y la encuesta por cuestionario. Se propuso y probó el modelo de integración de las herramientas de IA en el proceso educativo. Los resultados del estudio mostraron que las funciones de la IA tienen un poderoso potencial para mejorar el trabajo del profesor en el contexto de la optimización de los procesos educativos y aumentar su eficacia en general, lo que fue confirmado por el 98% de los encuestados. La clasificación de áreas prometedoras de aplicación de soluciones basadas en IA estaba encabezada por la implementación de estrategias de aprendizaje adaptativo (4,868 puntos), seguida de la retroalimentación y la evaluación (4,507 puntos), la generación de contenidos educativos ocupaba el tercer lugar (4,258 puntos), la gestión de actividades educativas el cuarto (4,139 puntos), la interacción y la comunicación el quinto (3,910 puntos). El artículo puede ser útil para profesores interesados en mejorar los efectos pedagógicos mediante soluciones digitales innovadoras. Las perspectivas de investigación pueden ser el estudio del impacto de las herramientas de IA en la mejora de la eficacia del aprendizaje de los estudiantes de posgrado, así como en el nivel de su motivación para el aprendizaje.

Palabras clave: Optimización del trabajo del profesor, gestión del proceso educativo, inteligencia artificial (IA), aprendizaje adaptativo, estrategias de aprendizaje, entorno educativo interactivo.

Introduction

The rapid technological progress, which affects all aspects of human life and activity, makes the issues related to the digital transformation of the educational system in order to prepare students for the challenges of the modern labour market especially important. Implementation of the strategy of digital transformation of educational services in educational institutions requires numerous researches and developments, as well as technical, organizational, labour, and cultural changes (Hashim et al., 2021).

The development of adaptive learning platforms is changing learning methods, offering innovative solutions and tools for obtaining practical learning experiences and distance collaboration. The flexibility of such platforms enables students to gain knowledge and experience in an environment that promotes independence and unimpeded learning (Apture et al., 2023). Virtual learning environments provide an immersive atmosphere for collaborative learning, interaction, information visualization, and real-time virtual feedback (Tapalova & Zhiyenbayeva, 2022). Cloud computing has become a necessary component of university education systems, and the AI capabilities to personalize the educational process taking into account the students' individual needs open up new prospects and clearly outline the priority vectors of higher education development in the era of digital innovations. The creation of an interactive, innovative educational environment is the goal of not only the management of HEIs and teachers, but also a means of promoting quality educational services in the global space.

Technological progress opens up a wide range of opportunities for effective pedagogical activity. Online learning technologies enable the adaptation of learning material and the use of blended learning models, giving students freedom in the mode and pace of learning, as well as flexible access to courses (Sîrghi et al., 2024). AI technologies are gradually changing the teachers' role in educational activities (Wang et al., 2021), as AI tools are increasingly integrated into educational practice, opening new opportunities for personalized and adaptive learning in an immersive educational environment, providing students with personalized support, improving their learning success. Deep learning approaches have demonstrated positive effects on enhancing learning motivation, promoting personalized learning experiences, and improving assessment strategies (Shi et al., 2023). Personalized AI learning systems are able to qualitatively adapt educational content, pace and

learning resources to the unique characteristics and needs of each student, thereby creating a more effective and engaging learning environment.

AI technologies demonstrate advantages not only in the context of improving students' educational experience, but also in the context of optimizing the teachers' work, enabling them to achieve maximum efficiency in achieving pedagogical goals. However, even though AI adaptive learning systems are proactive systems in which students have access to a set of personalized learning tools that they can adapt to their personal preferences and skills, such systems do not guarantee learning motivation. A special role of teachers as instructors and moderators of educational activities is revealed in this aspect, which is becoming increasingly important (Bhutoria, 2022). Therefore, additional empirical research is needed to determine the AI potential to optimize teaching activities and the teacher's role in the students' interactive adaptive learning path.

Although the results of recent studies show the advantages of adaptive learning with the use of AI technologies to ensure effective learning, there are still insufficiently resolved issues regarding the optimization of pedagogical activity through the inclusion of AI tools in professional practice. Taking this into account, the aim of the article is to study the functional capabilities of artificial intelligence to optimize the work of teachers of HEIs. The aim was achieved through the fulfilment of the following research objectives:

- Develop a model for integrating AI tools into the educational process;
- Explore the functions and test AI tools during the three-month online course Artificial Intelligence in Pedagogy;
- Study the teachers' attitude to the integration of AI technologies in their professional activities;
- Assess the potential impact of AI tools on the optimization of the teacher's work in the following segments: i) planning, organization and management of educational activities; ii) creation and design of interactive educational content; iii) differentiation of educational resources and organization of a personalized interactive learning environment; iiii) organization of joint work of students and creation of a single learning space for active learning and communication; iiii) development of a system for evaluating educational achievements and providing feedback.

Literature Review

The concept of adaptive learning is based on the idea that students have different cognitive abilities, experiences and learning preferences. The functions of AI open up new opportunities for the implementation of personalized adaptive learning, taking into account the individual abilities and needs of each student. Adaptive learning supported by artificial intelligence tools, uses training data and machine learning algorithms to create dynamic and interactive learning processes, develop individual learning trajectories, provide personalized feedback and analyse the learning progress of each student. AI algorithms can continuously monitor student progress and adjust the level of difficulty of learning content accordingly, generate detailed performance analytics reports, and provide predictive analytics to identify potential learning gaps or areas for improvement (Akavova et al., 2023). Furthermore, AI and machine learning algorithms can analyse student interactions, group dynamics, and social media data to provide personalized recommendations for group projects, collaborative learning activities, and constructive feedback (Gligorea et al., 2023). Educational AI-based applications can qualitatively influence the modernization of the learning environment: from personalization of learning to the development of modern virtual classrooms and conditions for obtaining an interactive learning experience (López-Chila et al., 2024).

Diao (2020) claims that the use of artificial intelligence in education can help teachers to develop higher quality current educational content, improve it and adapt it to the students' personal needs through the integration of feedback tools, the creation of personalized learning trajectories and the evaluation of educational achievements with the use of educational data analytics tools, which will significantly reduce the burden on teachers and increase the effectiveness of education. According to Salido (2023), AI can help teachers to save time by automating administrative processes such as grading assignments, tracking student attendance, and preparing lessons. AI can also help to identify knowledge gaps and learning difficulties for students and provide them with additional support to improve overall performance. This view is consistent with the opinion of Liu (2023), that smart analysis and assessment of the level of student training on educational platforms make it possible to establish a multi-level topological connection with educational resources through the use of intelligent tags, creating a knowledge map by year of study, which enables teachers to implement a personalized educational approach with minimal time spent.

Today, generative artificial intelligence (GenAI) is penetrating various fields of activity and demonstrates its functional advantages. Unlike machine learning (ML) algorithms, whose functions are aimed at analysing and interpreting data, GenAI is designed to create new, original results by generating new content (text, images, audio, and video), thereby being functionally capable of solving more complex tasks (Li et al., 2024). Moreover, GenAI can perform many functions and tasks to effectively organize educational activities, including the creation of personalized educational content, realistic simulations, or engaging virtual learning environments (Lee et al., 2023). GenAI has the potential to change the educational landscape by offering adaptive learning pathways and releasing teachers from routine responsibilities (Mishra et al., 2024).

According to Wu (2023), it is important to recognize the unique strengths and weaknesses of the integration of GenAI into education, the practical use of which must preserve important aspects of the human learning experience relying on the fundamental ideas of learning theories, witnessing the dawn of a new era in the field education and training. This view is supported and supplemented by the study of Li et al. (2024), who believe that a deeper understanding of learning processes can be achieved by applying GenAI in the process of developing personalized learning methods. Improved results in learning can be achieved by creating a symbiotic relationship between the development of AI and the theory of education.

The researchers from the UAE (Kamalov et al., 2023) studied the potential impact of AI on education in three main areas: applications, benefits and challenges. They identified several challenges related to the AI implementation, which include data privacy, security and bias in the teacher/student relationship. It is worth noting that the fight against cybercrime is currently a problem not only in Ukraine, but also in the whole world. According to the authors of the study on the causes of fraud using IT technologies (Punda et al., 2023), the development of information technologies (IT) has significantly expanded the types of cybercrimes and accelerates their occurrence. Active participants of virtual interactions need to protect personal data from the technical side and take preventive measures in order to avoid dangers in the Internet. The article by Fusco (2022) covers the issue of AI-generated fake news. He believes that raising public awareness through media literacy and critical thinking campaigns is critical to building a more informed and sustainable society. Teaching AI literacy and ethics should be integrated into thematic curricula to foster an inclusive, equitable, and effective learning environment that meets the diverse needs of the 21st-century learners. When implementing AIEd in educational practice, it is necessary to observe flexibility in decision-making, as careful implementation of AIEd may not always lead to the desired results, because students do not necessarily perceive the implementation of these technologies positively (Rodway & Schepman, 2023).

According to the authors of the article, the process of updating educational approaches and implementing advanced technological achievements to improve the quality and efficiency of educational activities is becoming relevant for practicing teachers in the current conditions. Besides, new opportunities for the use of technological solutions for the improvement of pedagogical activity, its optimization and adaptation to modern trends open up for teachers.

Methods and Materials

Research design

At the initial stage of the study of the potential impact of AI tools on optimizing the teacher's work and increasing its effectiveness, the authors developed a model for integrating AI tools into the educational process (Figure 1). The model demonstrated five areas of pedagogical work that can benefit from interaction with modern educational AI tools. The model revealed the potential of system interaction of AI tools to ensure an effective educational process, as well as outlined the principles of implementing post-graduate education using the AI capabilities.

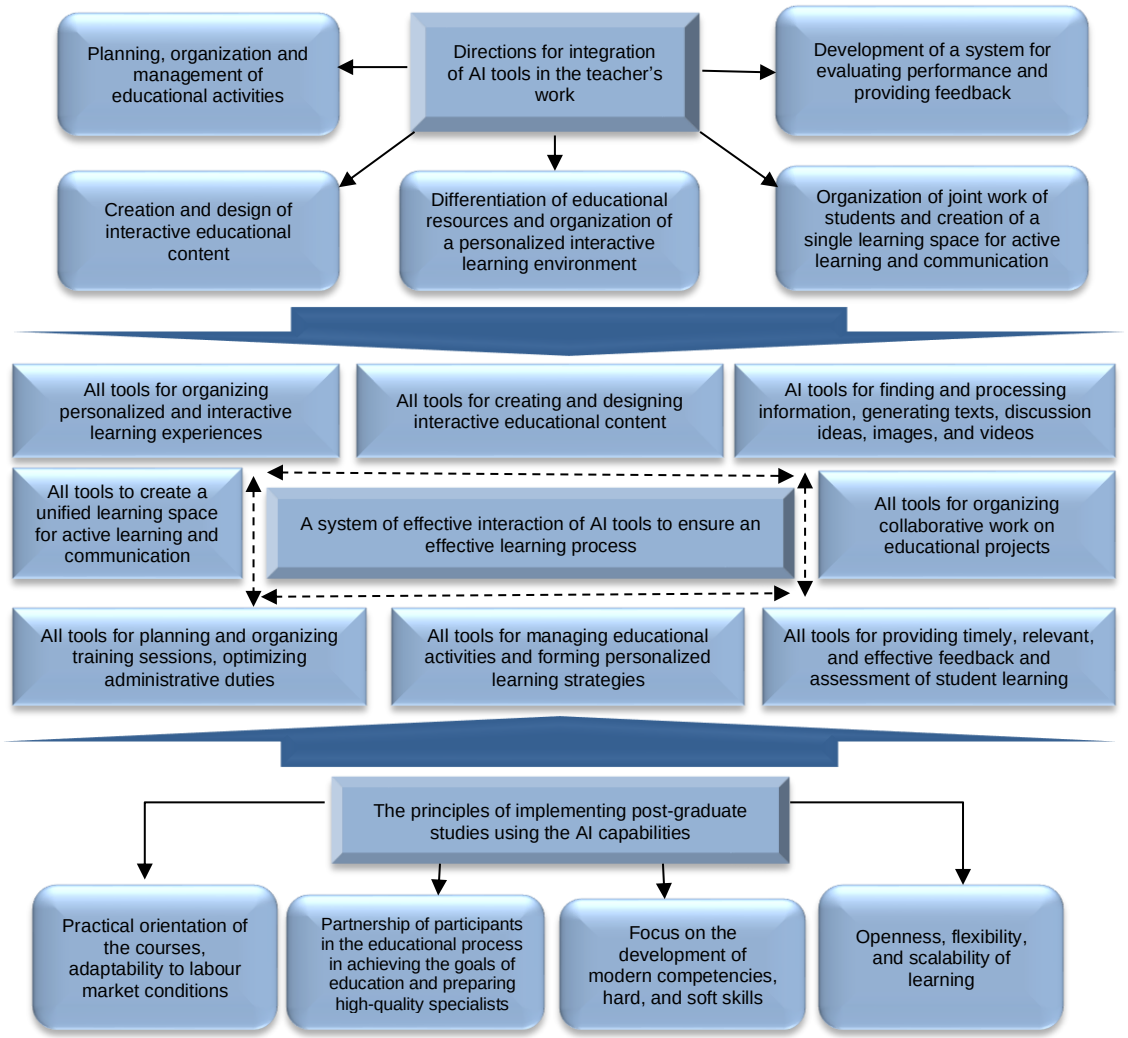

Figure 1. Model of integration of AI tools in the educational process
Source: developed by the author

At the next stage of the research, the authors conducted an online seminar entitled the Possibilities of Artificial Intelligence in Improving the Quality of Postgraduate Education on the Google Meet communication platform (https://meet.google.com/), involving postgraduate education teachers of Borys Grinchenko Kyiv Metropolitan University and Kirovohrad Regional In-Service Teacher Training Institute named after Vasyl Sukhomlynskyi. The invitation and the registration form for participation in the seminar were sent by e-mail to the administrators of the departments. The seminar involved a total of 134 people. The participants of the seminar were given the opportunity to learn more about the functionality of AI tools during the free training course, for which 97 people registered.

Based on the author's model of integration of AI tools into the educational process, the authors developed and delivered a three-month online course — Artificial Intelligence in Pedagogical Activity, which was offered in a mobile application developed on the SkillzRun platform (https://skillzrun.com/). Course participants had the opportunity to explore the AI tools, test them, and explore the possibilities of using them to improve and optimize their pedagogical activities. The training course included 7 modules designed to reveal the potential of individual AI tools to improve the effectiveness of the teacher's work and optimize it.

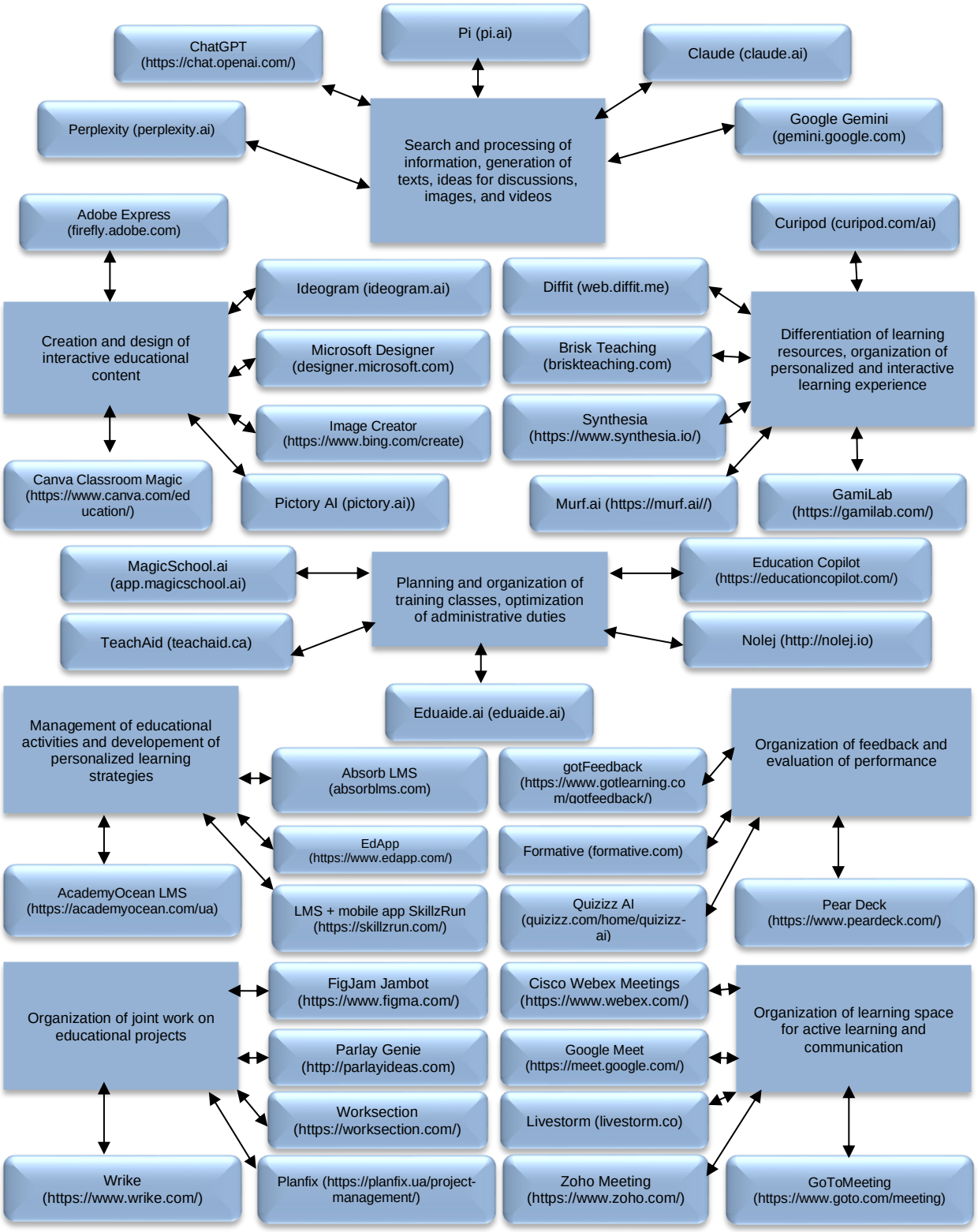

Figure A.1. AI tools explored and tested by the course participants.
**Developed by the author*

Sample

The training took place from January to April 2024 involving 97 postgraduate education teachers (Table 1). Four educational groups were formed using the method of random selection (Group 1 — 25 teachers, Group 2 — 23, Group 3 — 24, Group 4 — 25). The training course was moderated by 4 teachers of the Institute of Postgraduate Education of Borys Grinchenko Kyiv Metropolitan University. All participants of the training course took part in the survey, which was conducted upon the completion of the course.

Table 1.
Participants of the training course

Number of respondent teachers (people)	Teaching experience (years)	HEI
32	7-17	The Institute of Postgraduate Education of Borys Grinchenko Kyiv Metropolitan University, the Department of Preschool and Primary Education
36	9-19	Kirovohrad Regional In-Service Teacher Training Institute named after Vasyl Sukhomlynskyi
29	3-20	The Institute of Postgraduate Education of Borys Grinchenko Kyiv Metropolitan University, Department of Science and Mathematics Education and Technologies

Methods

The research was conducted using empirical methods such as experiment, observation, and questionnaire survey. The experiment method was used for developing the structure of the course and its implementation in order to test the functionality of AI tools. The observation method was used by the authors of the study when administering the educational course in order to identify the effectiveness of the developed model of integration of AI tools in the educational process. The questionnaire survey method was implemented after the completion of the training course in order to identify promising directions for the optimization of pedagogical activity using the functional capabilities of AI tools. The survey of respondents — postgraduate education teachers — was conducted at the beginning of April 2024 in a mobile application on the SkillzRun platform. The purpose of the survey was to study the teachers' attitude to the functional capabilities of AI tools in the context of optimizing the teacher's work and increasing its efficiency. The survey questionnaire was developed by the authors of the training course (Appendix B, Table B.1 (please use https://docs.google.com/document/d/1AXniAGxp7TfrmqtuSXbsw5WC8_hgWkkSt0Fw1L7yIMs/edit?usp=sharing)). The questionnaire was checked for validity and reliability. The Pearson correlation coefficient was 0.87, which indicates that the questionnaire has high validity. Cronbach's alpha ranges from 0.84 to 0.89, which indicates that the internal consistency of the questionnaire scale is quite high, the questions in the questionnaire are homogeneous and interconnected.

Instruments

The obtained data were analysed and processed using statistical methods and Microsoft Office Excel software. The survey used a psychometric Likert scale in 5 gradations: 1 — absolutely does not affect; 2 — does not affect; 3 — partially affects; 4 — affects to a large extent; 5 — maximum effect. Respondents' questionnaires were sorted by relevance, an independent sample T-test was performed, and the results showed no significant difference (P> 0.049). Harman's univariate method was used to check the systematic error of the general method. The variance of the first factor was 34.57% (less than 50%), confirming the absence of systematic error of the general method in this study.

Ethical criteria

The study was developed in accordance with the recommendations of the Declaration of Helsinki, the respondents gave written consent to participate in the study, personal data processing. The survey was anonymous and the obtained data were used in a generalized form only.

Results

The results of the survey of respondents after the completion of the training course Artificial Intelligence in Pedagogical Activities demonstrated the teachers' positive attitude towards the integration of AI technologies in their professional activities. In particular, according to 89% of respondents, the integration of AI technologies can improve the quality and efficiency of interaction with students. A total of 86% of respondents believed that the use of AIEd technologies greatly facilitates the educational process, making it convenient for both teachers and students. According to 97% of the respondents, the use of AIEd technologies contributes to the creation of a modern and exciting learning environment that engages students in learning and promotes better assimilation and retention of knowledge. Furthermore, 95% of respondents believed that AIEd tools optimize the organizational aspects of their pedagogical activities and direct efforts to improve pedagogical skills. According to 93% of surveyed teachers, AIEd tools enable generating a variety of learning situations and simulating an immersive environment for acquiring practical skills and abilities. A total of 98% of respondents believed that the use of AIEd technologies can improve the quality of education in general.

The results of teachers' assessment of the influence of the functional capabilities of AI tools on the optimization of pedagogical work and increasing its effectiveness are presented in Appendix C, Table C.1 (please use https://docs.google.com/document/d/1AXniAGxp7TfrmqtuSXbsw5WC8_hgWkkSt0Fw1L7yIMs/edit?usp=sharing). Segment C "Differentiation of educational resources and organization of a personalized interactive environment" with an average score of 4.868 ranked first in terms of the impact of AI tools on the optimization of the teacher's work. Segment E. "Development of a system for evaluating performance and providing feedback" ranked second with an average score of 4.507. Segment B. "Creation and design of interactive educational content" ranked third with an average score of 4.258. Segment A. "Planning, organization and management of educational activities" ranked fourth in the influence ranking with an average score of 4.139. Segment D. "Organization of joint work of students and creation of a single learning space for active learning and communication" ranked fifth with an average score of 3.910.

According to the respondents, AIEd tools are maximally able to optimize the teacher's work in the field of planning, organization, and management of educational activities due to the function of mobile learning with the ability to organize effective distance learning, flexible access, gamification, automation of assessment and certification of knowledge. The respondents highly rated the potential of using AIEd tools in the work of creating a single knowledge base with structured materials, building a system of effective communication and student interaction. Figure D.1

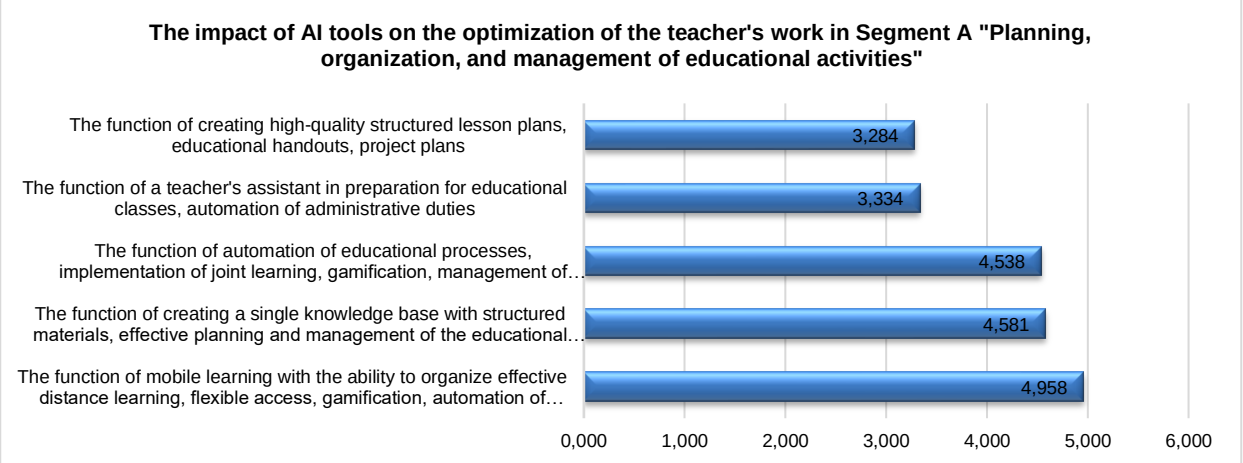

Figure D.1. Assessment of the impact of AI tools on optimizing the teacher's work in Segment A.
**Developed by the author*

According to the respondents, AI tools are able to maximally influence the optimization of the teacher's work in the creation and design of interactive educational content due to the function of automatic creation of interactive content based on textbooks, videos, and online media resources. The respondents highly rated the function of a chatbot with GenAI for searching and processing information, generating texts, ideas for discussions, images, and videos. Figure D.2

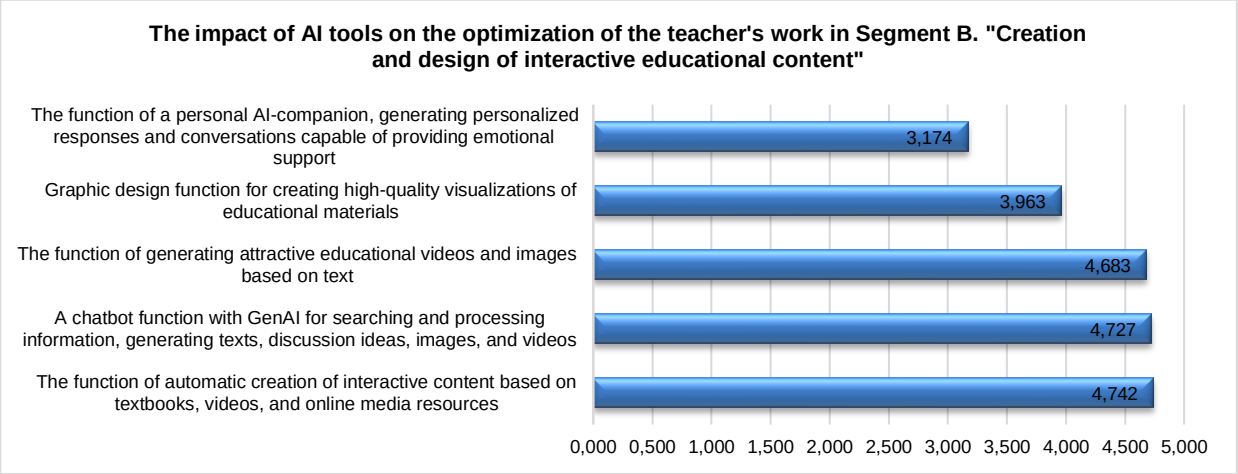

Figure D.2. Assessment of the impact of AI tools on optimizing the teacher's work in Segment B.
** Developed by the author*

The AI function of creating differentiated learning resources for different types of student activities and personalized learning experience was highly rated by educators in Segment B. Moreover, the respondents gave high ratings to the function of creating complex personalized learning strategies for key competencies and the function of creating interactive presentations, meetings, and seminars, development of interactive games and tasks. Figure D.3

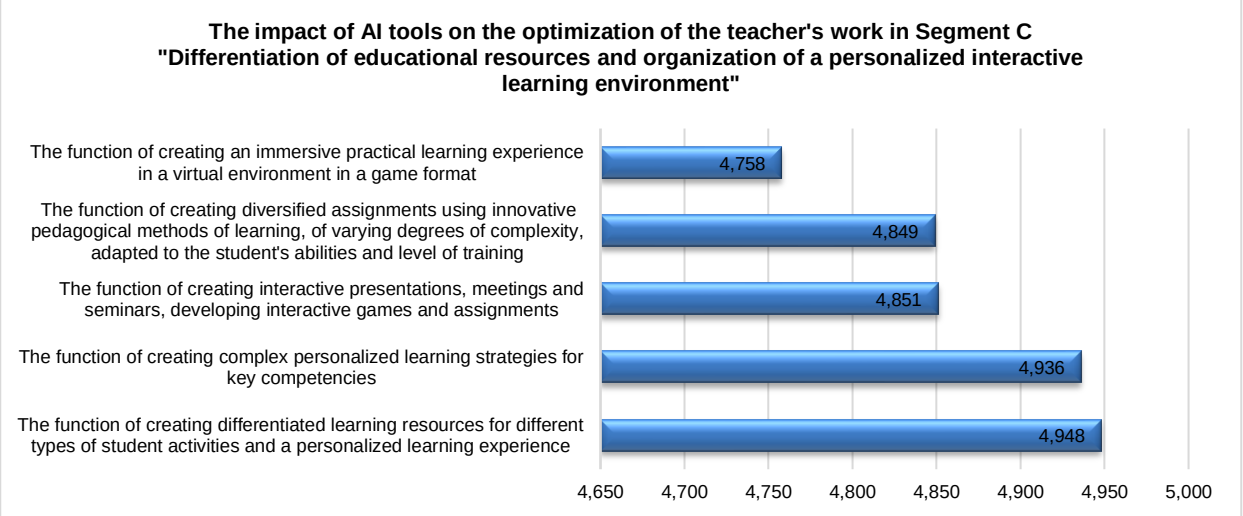

Figure D.3. Assessment of the impact of AI tools on optimizing the teacher's work in Segment C
** Developed by the author*

According to the respondents, AI tools are able to maximally influence the optimization of the teacher's work related to the organization of students' joint work and the creation of a single space for active learning and communication due to the functions of generating questions for higher-order discussions (ideas for

brainstorming) based on the topic, YouTube videos or articles, and features of educational gamification in a virtual environment in real time Figure D.4

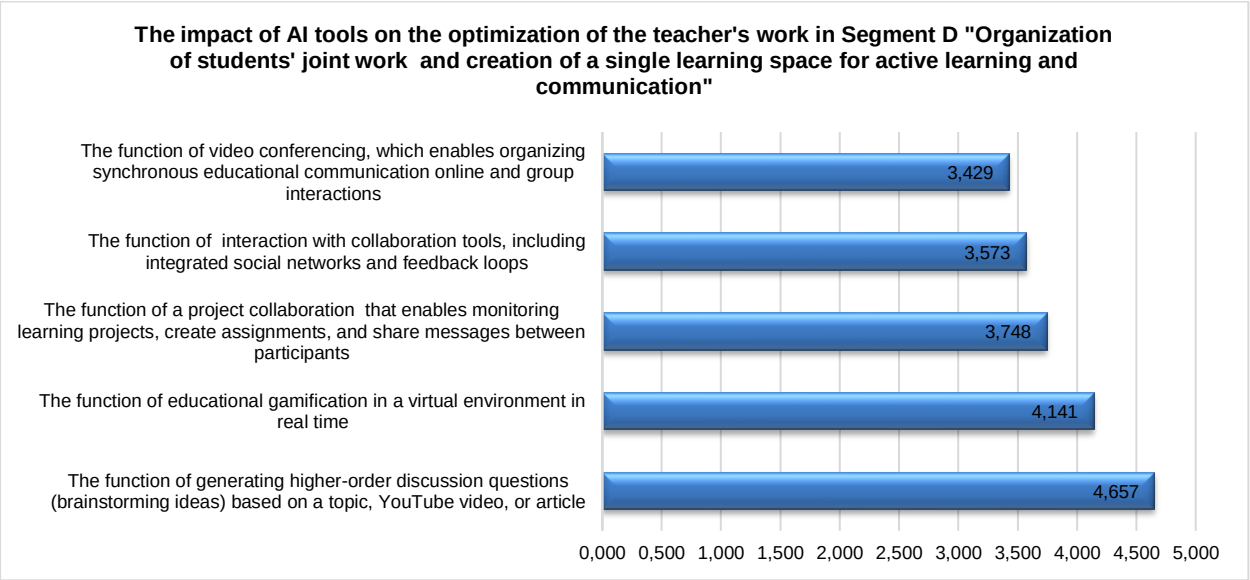

Figure D.4. Assessment of the impact of AI tools on optimizing the teacher's work in Segment D
** Developed by the author*

The respondents highly rated the AI potential in the development of a system for assessing learning achievements and providing feedback to students, namely the function of providing personalized, goal-oriented, timely, continuous, and consistent feedback and the function of assessing and identifying skill gaps, and provision of personalized practical recommendations. Figure D.5

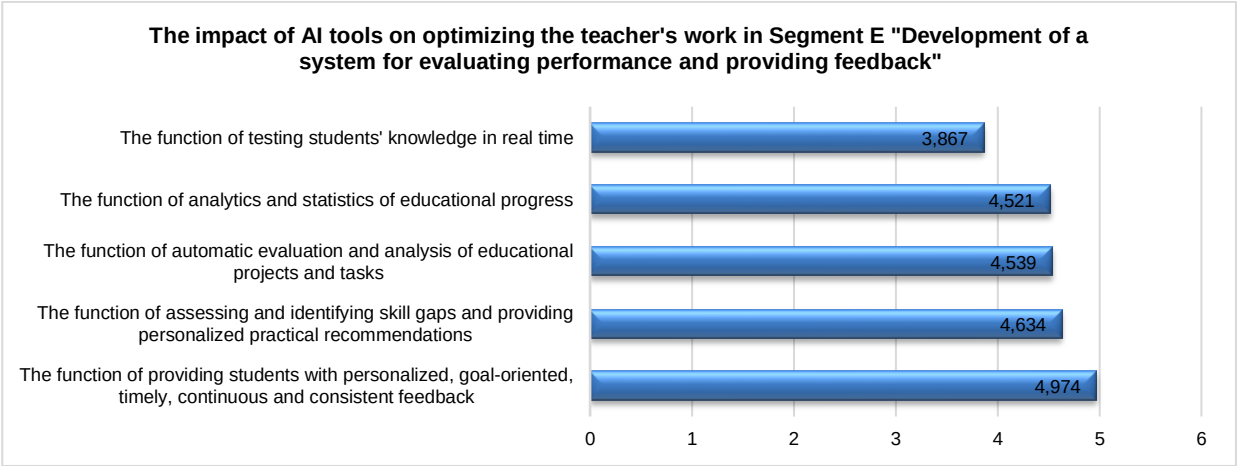

Figure D.5. Assessment of the impact of AI tools on optimizing the teacher's work in Segment D
** Developed by the author*

In order for the AI tools to maximally reveal their potential in educational activities, the management of HEIs must direct administrative and organizational efforts to ensure the teachers' ability to improve digital literacy in the field of AI. The teachers should:

- Have sufficient digital skills to organize educational activities on educational online adaptive learning platforms;
- Have the skills to develop interactive educational content for individual and group learning using machine learning and GenAI technologies;
- Have the skills of organizing a system of cooperation and social learning, in particular working on joint projects, organizing discussion forums and discussions in social networks integrated with online learning platforms;
- Have the skills to develop personalized educational recommendations and learning strategies using GenAI technology, taking into account the abilities and needs of each student;
- Have the skills to work with educational data analytics;
- Have the skills of interaction with the virtual educational environment in the field of providing constructive feedback on educational issues, forming a system for evaluating individual and collective educational results;
- Have the skills of supervising the course: ensuring the quality of the course and updating the content in the paradigm: relevance, accuracy, educational value;
- Have the skills to scale the course and implement the principle of open and accessible education.

Discussion

Our study was aimed at evaluating the teachers' attitude to innovative AI-based technologies and the possibilities of using certain AI tools in the professional activities of postgraduate education teachers. This orientation was determined by the fact that modern post-graduate education has entered a special phase of relevance in view of the current challenges, and also needs the latest approaches to its organization. The authors proposed a model in which the principles of implementing post-graduate education in the current conditions are outlined, in particular: i) practical orientation of courses, adaptability to labour market conditions; ii) partnership of participants in the educational process in achieving educational goals and high-quality training of specialists; iii) focus on the development of modern competencies, hard, and soft skills; iiii) openness, flexibility, and scalability of training.

The survey results demonstrated the teachers' positive attitude towards the integration of AI technologies in their professional activities. Being able to explore and test the functionality of AI tools, the participants of the initial course agreed that artificial intelligence has a strong potential to improve the teacher's work in the content optimization of educational processes and increase their effectiveness in general. This is consistent with the results of Bower et al. (2024), who evaluated the teachers' attitude to the implementation of AI tools in pedagogical activity and found that AI can become a valuable catalyst for positive changes in education, particularly in assessment methods. The authors Rulinawaty et al. (2023) confirm that the organization of training on online platforms for adaptive learning is able to optimize the training process and increase its effectiveness due to the creation of a more dynamic, flexible, and inclusive educational environment. Asynchronous learning in an online environment provides flexibility and makes education more adapted to the students' individual needs due to the use of cloud computing and a learning management system. The implementation of personalized learning with the help of machine learning tools can enhance students' learning motivation and improve its effectiveness. The combination of self-study and interactive elements of courses on online platforms make learning modern and comfortable for the students.

The results of our research showed that the combination of educational tools based on machine learning and GenAI integrated into the educational process provides excellent outcomes in creating strategies for effective adaptive personalized learning. The results of a study of the impact of AI on the organization of educational activities conducted by American scientists (Latif et al., 2024) showed that the integration of AI into pedagogical design can provide differentiated learning and support the diverse needs of students. The results of a quantitative and qualitative analysis of the impact of AI and computer science components on the effectiveness of teaching conducted by Spanish researchers (García-Martínez et al., 2023) revealed

that the use of AI in education can provide significant support to teachers at all stages of the educational process, optimize opportunities and resources to create an effective learning environment.

Exploring the possibilities of using ChatGPT in education, researchers van den Berg & du Plessis (2023) concluded that generative AI can provide teachers with constructive assistance in lesson planning by providing specific materials and support mechanisms that will allow contextualizing educational materials and adapting to specific contexts and student groups. Besides, generative AI can make connections between different subjects and provide interdisciplinary learning content and experiences (Yu & Guo, 2023). The results of our research support the idea that GenAI has the potential to create effective learning environments. Furthermore, the generation of interactive learning content for group learning using GenAI reveals its potential in creating an effective interactive environment for learning interactions and creating an environment of situational practical learning.

According to American researchers, adaptive learning platforms that already include machine learning provide an ideal environment for realizing the benefits of GenAI, which increase the efficiency of existing machine learning algorithms (Li et al., 2024). This is also consistent with the results of our study, in which the teachers confirmed that the integration of AIEd digital tools based on machine learning and GenAI can positively affect the improvement and optimization of pedagogical activities, as well as the improvement of the quality of postgraduate training in general. In the context of optimizing teaching activities, GenAI is able to reduce the time spent on content creation. The results of a study by Dickey & Bejarano (2023) show that GenAI can be useful in the stage of creating educational content with its ability to model multiple points of view, which will allow teachers to create a more holistic and inclusive educational experience, as well as facilitate the effective adaptation of the created content to the course-specific purposes.

In view of a significant potential of AI technologies in improving pedagogical activity, it is necessary to take into account the problems that arise in the process of implementing digital approaches to the organization of the educational process. According to Allam et al. (2023), privacy is a key issue at the stage of introducing AI tools into the educational process. AI systems that interact with students' personal data must meet the strictest data protection and monitoring standards. Moreover, teachers need to understand the limitations, potential risks, and ethical issues associated with the use of these technologies. The authors of a study on the impact of AI on pedagogical activities (Tang, 2024) concluded that the use of AI may be limited by infrastructure requirements, inclusiveness and equity, teacher readiness and training, data privacy and ethics, and the possibility of unequal access to technologies. Our research reveals the potential of AI digital literacy training for teachers as an opportunity to minimize the risks associated with the use of AI in education, but does not take into account the technical aspects of its ecological implementation and does not offer ways to solve the problem of technological inequality.

The researchers (Jaboob et al., 2024) believe that GenAI has enormous potential to transform teaching in higher education if implemented thoughtfully and ethically. This is consistent with the opinion of Shanto et al. (2023), who believe that the progressive joint efforts of the management of educational institutions, teachers, researchers, and technologists will be crucial in overcoming obstacles to the competent implementation of GenAI tools in educational activities of HEIs. According to Antonopoulou et al. (2023) it is important to achieve a balance between virtual online learning and real classroom learning, which should depend on various factors, including the subject, the purpose of learning, as well as the students' individual preferences and needs.

Conclusions

The development of AI-based educational technologies has opened new opportunities for the improvement of pedagogical activity, its optimization and adaptation to modern trends for teachers of HEIs. The possibilities of updating educational approaches and methods with the integration of advanced technological achievements that increase the quality and efficiency of educational activities are studied in the article. The results of the study demonstrated the enormous potential of using AIEd to implement

effective training of students in the field of postgraduate education. A survey of respondents — teachers of HEIs of Ukraine showed that the integration of AI technologies improves the quality of interaction with students (89%); significantly simplifies the educational process, making it convenient for both teachers and students (86%); enables creating a modern and exciting educational context that engages students in learning and promotes better assimilation and retention of knowledge (97%); optimizes organizational aspects of pedagogical activity and direct efforts to improve pedagogical skills (95%); enables generating a variety of learning situations and simulate an immersive environment for acquiring practical skills and abilities; improves the quality of education in general (98%).

The practical value of the research is the possibility of applying the author's model of integration of AI tools in the educational process for researching promising ways to optimize the teachers' work and creating strategies for improving education through the use of AIEd.

Research limitations

The main limitation of the study is its small sample: the survey involved 97 teachers from 3 HEIs of Ukraine. Furthermore, the inclusion of AI tools in the course Artificial Intelligence in Pedagogy was selective and their number was significantly limited. The study is of conceptual descriptive nature and requires a more thorough study using the method of quantitative and qualitative analysis of impact factors.

Bibliographic References

Akavova, A., Temirkhanova, Z., & Lorsanova, Z. (2023). Adaptive learning and artificial intelligence in the educational space. *E3S Web of Conferences, 451*. https://doi.org/10.1051/e3sconf/202345106011

Allam, H., Dempere, J., Akre, V., & Flores, P. (2023). Artificial intelligence in education (AIED): Implications and challenges. *Atlantis Highlights in Social Sciences, Education and Humanities, 13*. https://doi.org/10.2991/978-94-6463-286-6_10

Antonopoulou, K., Begkos, C., & Zhu, Z. (2023). Staying afloat amidst extreme uncertainty: A case study of digital transformation in Higher Education. *Technological Forecasting & Social Change, 192*, 122603. https://doi.org/10.1016/j.techfore.2023.122603

Apture, S., Kalkoti, F., Sardar, A., Ahsan, M., & Tare, R. (2023). Personalized artificial intelligence enhanced learning platform. *International Research Journal of Modernization in Engineering, Technology and Science, 5*(12). https://www.doi.org/10.56726/IRJMETS47868

Bhutoria, A. (2022). Personalized education and artificial intelligence in the United States, China, and India: A systematic review using a Human-In-The-Loop model. *Computers and Education: Artificial Intelligence, 3*, 100068. https://doi.org/10.1016/j.caeai.2022.100068

Bower, M., Torrington, J., Lai, J. W. M., Petocz, P., & Alfano, M. (2024). How should we change teaching and assessment in response to increasingly powerful generative Artificial Intelligence? Outcomes of the ChatGPT teacher survey. *Education and Information Technologies*, *29*, 15403-15439. https://doi.org/10.1007/s10639-023-12405-0

Diao, S. (2020). The reform of teaching management mode based on artificial intelligence in the era of big data. *Journal of Physics: Conference Series*, *1533*, 042050. https://doi.org/10.1088/1742-6596/1533/4/042050

Dickey, E., & Bejarano, A. (2023). A model for integrating generative AI into course content development. *Computers and Society*. https://doi.org/10.48550/arXiv.2308.12276

Fusco, F. (2022). Artificial intelligence and fake news: Criminal aspects in Pakistan and Saudi Arabia. *Pakistan Journal of Criminology, 14*(4), 19-33. Retrieved from https://acortar.link/txJVlT

García-Martínez, I., Fernández-Batanero, J. M., Fernández-Cerero, J., & León, S. P. (2023). Analysing the impact of artificial intelligence and computational sciences on student performance: Systematic review and meta-analysis. *Journal of New Approaches in Educational Research, 12*(1), 171-197. https://doi.org/10.7821/naer.2023.1.1240

Gligorea, I., Cioca, M., Oancea, R., Gorski, A.-T., Gorski, H., & Tudorache, P. (2023). Adaptive learning using artificial intelligence in e-learning: A literature review. *Education Sciences*, *13*, 1216. https://doi.org/10.3390/educsci13121216

Hashim, M.A.M., Tlemsani, I., & Matthews, R. (2021). Higher education strategy in digital transformation. *Education and Information Technologies, 27*(3), 3171-3195. https://doi.org/10.1007/s10639-021-10739-1

Jaboob, M., Hazaimeh, M., & Al-Ansi, A.M. (2024). Integration of generative AI techniques and applications in student behavior and cognitive achievement in Arab higher education. Integration of generative AI techniques and applications in student behavior and cognitive achievement in Arab higher education. *International Journal of Human–Computer Interaction, 41*(1), 353-366. https://doi.org/10.1080/10447318.2023.2300016

Kamalov, F., Santandreu Calonge, D., & Gurrib, I. (2023). New era of artificial intelligence in education: Towards a sustainable multifaceted revolution. *Sustainability, 15*, 12451. https://doi.org/10.3390/su151612451

Latif, E., Mai, G., Nyaaba, M., Wu, X., Liu, N., Lu, G., … & Zhai, X. (2024). Artificial general intelligence (AGI) for education. *arXiv preprint arXiv:2304.12479, 1*. https://doi.org/10.48550/arXiv.2304.12479

Lee, A.V.Y., Tan, S. Ch., & Teo, Ch. L. (2023). Designs and practices using generative AI for sustainable student discourse and knowledge creation. *Smart Learning Environments*, *10*, 59. https://doi.org/10.1186/s40561-023-00279-1

Li, H., Xu, T., Zhang, Ch., Chen, E., Liang, J., Fan, X., … & Wen, Q. (2024). Bringing generative AI to adaptive learning in education. *arXiv preprint arXiv:2402.14601.* https://arxiv.org/pdf/2402.14601.pdf

Liu, M. (2023). Exploration of digital transformation schema for professional degree postgraduate training. *Journal of Software Engineering and Applications*, *16*, 685-694. https://doi.org/10.4236/jsea.2023.1612035

López-Chila, R., Llerena-Izquierdo, J., Sumba-Nacipucha, N., & Cueva-Estrada, J. (2024). Artificial intelligence in higher education: An analysis of existing bibliometrics. *Education Sciences*, *14*, 47. https:/doi.org/10.3390/educsci14010047

Mishra, P., Oster, N., & Henriksen, D. (2024). Generative AI, teacher knowledge and educational research: Bridging short- and long-term perspectives. *TechTrends, 68*(2), 205-210. https://doi.org/10.1007/s11528-024-00938-1

Punda, O., Vavrynchuk, M., Kohut, O., Kravchuk, S., & Prysiazhniuk, M. (2023). The legal status and capabilities of cyber police in Ukraine: The reasons for the existence of frauds with the use of IT technologies. *Pakistan Journal of Criminology, 15*(2), 165-180. Retrieved from https://www.pjcriminology.com/wp-content/uploads/2023/08/12_Punda-et-al.pdf

Rodway, P., & Schepman, A. (2023). The impact of adopting AI educational technologies on projected course satisfaction in university students. *Computers and Education: Artificial Intelligence, 5*, 100150. https://doi.org/10.1016/j.caeai.2023.100150

Rulinawaty, Priyanto, A., Kuncoro, S., Rahmawaty, D., & Wijaya, A. (2023). Massive open online courses (MOOCs) as catalysts of change in education during unprecedented times: A narrative review. *Journal of Science Education Research*, *9*(Special Issue), 53–63. https://doi.org/10.29303/jppipa.v9iSpecialIssue.6697

Salido, V. (2023). Impact of AI-powered learning tools on student understanding and academic performance. *BAPS 85: Introduction to Political Analysis and Research*. https://doi.org/10.13140/RG.2.2.17259.31521

Shanto, S.S., Ahmed, Z., & Jony, A.I. (2023). PAIGE: A generative AI-based framework for promoting assignment integrity in higher education. *STEM Education, 3*(4), 288–305. https://doi.org/10.3934/steme.2023018

Shi, L., Umer, A.M., & Shi, Y. (2023). Utilizing AI models to optimize blended teaching effectiveness in college-level English education. *Cogent Education*, *10*, 2282804. https://doi.org/10.1080/2331186X.2023.2282804

Sîrghi, N., Voicu, M.-C., Noja, G. G., & Socoliuc, O.-R. (2024). Challenges of artificial intelligence on the learning process in higher education. *Amfiteatru Economic Journal, The Bucharest University of Economic Studies, 26*(65), 53-70. https://doi.org/10.24818/EA/2024/65/53

Tang, K.H.D. (2024). Implications of artificial intelligence for teaching and learning. *Acta Pedagogia Asiana, 3*(2), 65−79. https://doi.org/10.53623/apga.v3i2.404

Tapalova, O., & Zhiyenbayeva, N. (2022). Artificial intelligence in education: AIEd for personalised learning pathways. *The Electronic Journal of e-Learning, 20*(5), 639-653. https://doi.org/10.34190/ejel.20.5.2597

van den Berg, G., & du Plessis, E. (2023). ChatGPT and generative AI: Possibilities for its contribution to lesson planning, critical thinking and openness in teacher education. *Education Sciences, 13*, 998. https://doi.org/10.3390/educsci13100998

Wang, Y., Liu, C., & Tu, Y.-F. (2021). Factors affecting the adoption of AI-based applications in higher education: An analysis of teachers' perspectives using structural equation modeling. *Educational Technology & Society, 24*(3), 116–129. https://www.jstor.org/stable/27032860

Wu, Y. (2023). Integrating generative AI in education: How ChatGPT brings challenges for future learning and teaching. *Journal of Advanced Research in Education*, 2(4). https://doi.org/10.56397/JARE.2023.07.02

Yu, H., & Guo, Y. (2023). Generative artificial intelligence empowers educational reform: Current status, issues, and prospects. *Frontiers in Education, 8*, 1183162. https://doi.org/10.3389/feduc.2023.1183162