IMPLEMENTING PROJECT-BASED LEARNING USING ARTIFICIAL INTELLIGENCE

ЗДІЙСНЕННЯ ПРОЄКТНОГО НАВЧАННЯ З ВИКОРИСТАННЯМ ШТУЧНОГО ІНТЕЛЕКТУ

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Project-based learning in the education system is gaining more and more momentum, as it is promising and contributes to the formation of all the necessary life skills for of students of professional preliminary higher education. It allows the development of their critical thinking and creative abilities. The application of artificial intelligence in education is an actual area of research that contributes to increasing the effectiveness of the educational process. Implementation of project-based learning using artificial intelligence (AI) is becoming increasingly urgent in education. This approach makes it possible to significantly increase the motivation of students, stimulate their independence and creativity, and prepare them to solve real problems in the modern world, where AI plays an increasingly important role. The purpose of the study is to highlight the possibilities and prospects of using artificial intelligence to implement project-based training of students of professional preliminary higher education. The research is conducted using mixed methods, including quantitative and qualitative approaches. Data are analyzed using statistical methods and interviews are conducted with participants in the educational process. During the research and presentation of the material, theoretical methods of scientific knowledge were used: analysis and synthesis, induction and deduction, systematization, and generalization. The author hypothesizes that the use of AI in project-based learning helps to increase the motivation of students, strengthens their independence, improves the skills of working with information and critical thinking, and also stimulates teamwork. It has been established that using artificial intelligence significantly increases the effectiveness of project-based learning. Its main advantages for teachers are described, including the automation of routine tasks. Positive results for students in the form of improved learning outcomes are summarized. Recommendations for the implementation of artificial intelligence services in the educational process, in particular, in project activities, are offered. The main areas for further research are systematized. The results of the study can be used for further development of the theory of project-based learning and artificial intelligence in education. The recommendations developed by the authors regarding the implementation of artificial intelligence in project-based learning. These recommendations can be used by teachers and lecturers to optimize the educational process, increase its effectiveness, and form the competencies necessary for a successful life in modern society for students. Further research can be aimed at developing new methods and tools for using AI in project-based learning, studying its impact on various aspects of students' educational activities, as well as studying the ethical aspects of using AI in education.

Key words: project-based learning; project; pre-higher education; students of vocational pre-higher education; artificial intelligence.
INTRODUCTION

The modern world faces constant challenges and changes: the COVID-19 pandemic, the introduction of martial law in Ukraine. Under such conditions, trends in the development of education require its constant transformation and adaptation. In this context, the transition to innovative teaching methods becomes not only a matter of academic discussion, but also an urgent necessity. The challenges faced by graduates of professional pre-higher education institutions require their readiness to implement project activities in all spheres of society’s life in Ukraine, in Europe, and throughout the world [20, p.9]. The increasing complexity of tasks requires not only knowledge, but also deep understanding, critical thinking, creative activity and the ability to work in a team. In the multifaceted environment of project-based learning, artificial intelligence is great as a research assistant, project planner, and analytical tool.

LITERATURE REVIEW

The theoretical and practical principles of project-based learning of elementary school students are substantiated in the scientific investigations of many researchers. Thus, in the work of I. Yermakov, the competence potential of students’ project activities is highlighted [25]. O. Kobernyk analyzed the criteria of its organization: focus on the current problem; independent research; orientation to the final product; the teacher performs a partner role – he is an assistant, helps students in finding ways to solve the problem [9]. In the researches of N. Morze, O. Barna, V. Vember, and O. Kuzminska, the author’s approaches to the organization of computer science teaching in 5-6 grades of general educational institutions using the project method were presented; the influence of project activities of students on the formation of ICT competence was revealed [15].

Ukrainian and foreign experience in organizing project activities in professional (vocational and technical) education institutions is presented by the team of authors of the practical manual (V. Radkevich, O. Borodienko, L. Pukhovska, O. Samoilenko, O. Radkevich, N. Bazelyuk), in particular, practical tools for effective project activity [20]. N. Vanina and T. Pashchenko considered the project activity as a leading means of improving the quality of training of students of professional preliminary higher education [24]. The problem of preparing future teachers for the organization of project activities of pupils/students was revealed in the work of L. Savchenko, K. Safyan and I. Kovalenko [21].

In today’s conditions of dynamic development of information technologies, the problem of researching the process of organizing project-based learning becomes especially relevant. This is evidenced by the scientific achievements of many scientists (M. Antonchenko [2], O. Kyselova, M. Sin and K. Likhno [10], O. Kyselova, N. Khmil and A. Khmil [11] and others).

Recently, there has been rapid progress in technologies based on artificial intelligence (AI). In particular, in 2021, an «Action Plan for the Implementation of the Concept of the Development of Artificial Intelligence in Ukraine for 2021-2024» was developed, where the priority is to ensure legal regulation on issues of state policy formation in the field of artificial intelligence, holding conferences, seminars on the introduction and use of technologies of artificial intelligence, aimed at popularizing the basics of artificial intelligence in secondary education institutions, establishing scientific cooperation with international research centers [19]. The developers of the «Strategy for the Development of Artificial Intelligence in Ukraine» note that artificial intelligence has made great progress in recent decades: artificial intelligence systems control autonomous cars, translate into different languages, generate easy-to-read texts, and more. Preparing students to work with artificial intelligence is important for their future success in the digital world [22].

In their work, K. Peven, N. Khmil and N. Makogonchuk note the influence of artificial
intelligence on the change of traditional learning and teaching models [17]. L. Kartashova, T. Sorochan, T. Sheremet aptly note the revolution of chatbots based on AI, which is already taking place, and how it effectively helps in the adaptability and efficiency of students and teachers in improving the teaching process [8]. S. Lytvynova compared the capabilities of artificial intelligence, neural networks and chatbots for use in the educational practice of teachers [14].

In May 2024, the Ministry of Digital Transformation and the Ministry of Education and Science of Ukraine, together with the Working Group, which included 30 specialists – representatives of the Ministry of Education and Science, the scientific community, advanced training institutes, universities, schools, and the public sector, developed a draft of recommendations on the introduction and use of technologies of artificial intelligence in institutions of general secondary education. Their goal is to spread the principles and approaches to the responsible use of AI systems in general secondary education to observe human rights and professional ethical standards and raise teachers’ awareness about possible risks and challenges. This is to critically, effectively, and ethically interact with artificial intelligence systems and use all their potential. These recommendations are formed based on current international practices [7].

By analyzing the works of foreign and Ukrainian scientists, it is possible to draw an existing parallel in common conclusions. Project-based learning is an important tool that provides students with the opportunity not only to master theoretical material, but also to test it in practice, developing the skills of working with information, analyzing, and solving problems. In turn, the use of the latest digital tools, in particular artificial intelligence, in the process of project activity becomes a key aspect, as it allows to effective implementation of innovations, and increases productivity and efficiency. At the same time, despite the sufficient number of the above-mentioned studies, the problem of organizing project-based training for students of professional preliminary higher education requires further theoretical and practical development.

AIMS AND OBJECTIVES

The purpose of this article is to highlight the possibilities and prospects of using artificial intelligence for the implementation of project-based training of students of professional preliminary higher education.

METHODOLOGY AND RESEARCH METHODS

During the research and presentation of the material, theoretical methods of scientific knowledge were used: analysis and synthesis, induction and deduction, systematization and generalization.

RESULTS

In light of modern pedagogical research, project-based learning stands out as one of the promising approaches in the educational process of general education institutions. The main idea of project-based learning is to involve students in the active role of participants in the educational process, stimulating their interest and motivation. This is achieved by organizing educational activities in the form of projects that involve independent solving of specific tasks or problems. The theory of project-based learning defines the key role of student activity in the learning process. The studied approach is aimed at creating conditions for self-realization and independence of each participant in the educational process. It involves a change in the teacher’s role from an authoritarian to a facilitator, which promotes the development of creativity and initiative of students [23].

According to the definition of the Buck Institute for Education, project-based learning is a method by which students acquire the necessary knowledge and skills by researching and responding to real, interesting and complex questions for a certain period of time; it is a teaching method in which students learn by actively participating in real and personally meaningful projects [5]. Scientists believe that this kind of educational technology is capable of increasing the level of educational achievements of students [23]. In their works, the scientists of the scientific team (V. Anishchenko, M. Artushina, T. Herlyand, N. Kulalayeva, G. Romanova, L. Romanov, M. Shymانovsky) define project activity in a general secondary education institution as an educational and cognitive independent activity of students (with the participation of the teacher as a coordinator), aimed at the result achieved by solving a theoretically or practically significant task for them [1]. It is also a form of cognitive activity of subjects of education aimed at solving a personally perceived problem (task), in the process of which a certain project product is created [10].

According to researchers (Barron & Darling-Hammond, 2008; Thomas, 2000), project-based learning involves the following: students apply knowledge and skills to solve realistic problems in the real world; the student’s level of responsibility for the completed work increases; teachers perform the roles of trainers and research facilitators, conduct reflections; students often work in pairs or groups.

The practice of using artificial intelligence in the educational process is becoming more and more widespread. According to the indicators of Google Academy, a free search engine for full-text scientific publications, the number of works on the above-mentioned topic has been increasing for the past few years (Fig. 1).

In the context of modern realities, the organization and implementation of project-based training for students of vocational pre-higher education must adapt to the possibilities of artificial intelligence. It becomes not only a matter of choice, but also an urgent need.
The concept of «artificial intelligence» is a set of powerful technologies and programs embodied in machine algorithms, the purpose of which is to solve the tasks that society puts before it [18]. Artificial intelligence technology is actively used in education to transform and improve the level of training of a specialist during his education. Such educational aspects of artificial intelligence can be called, for example, personalized learning, smart content creation, adaptive access, virtual conversational assistants, analytics, forecasting, etc. [3].

Researchers focus on certain advantages of using artificial intelligence in education:
- improving learning efficiency: artificial intelligence can help students better learn material and achieve better results.
- personalization of learning: artificial intelligence can help students learn at their own pace and using the methods that work best for them.
- increasing the accessibility of education: artificial intelligence can make education more accessible to students with different needs and from different backgrounds.
- freeing up teachers’ time: artificial intelligence can automate many routine tasks so that teachers can focus on more creative and interactive aspects of teaching.
- improving communication: artificial intelligence can help improve communication between students, teachers and parents [16, p. 158].

In addition, scientists cite the following advantages of using AI in the teaching process: the use of chatbots, gamification, the development of educational platforms, and an additional source of automation tools that increase the productivity of human mental work [12].

We conducted a survey of teachers and students of vocational pre-university education regarding their awareness of artificial intelligence, as well as their attitude to its use during the organization of project activities. It turned out that the majority do not have the skills to use artificial intelligence, however, in connection with the wide coverage of its available opportunities from the perspective of application in various spheres of life, the overwhelming number of respondents expressed a positive attitude towards the use of artificial intelligence in the organization of project activities. They expect that the use of artificial intelligence in project activities would help them increase the amount of information available for project research, automate routine tasks, get new ideas and solutions for project implementation, improve communication and cooperation with teammates and experts, evaluate project results more objectively. In addition, they believe that artificial intelligence can help them increase the efficiency and effectiveness of project activities, develop 21st century competencies in project participants, and make the learning process more interesting and exciting.

Project work consists of the following stages: proposal and discussion of project topics; planning; selection of methods and resources, form of presentation of results; work on the project; preparation for defense and demonstration of the project [10]. It should be noted that it is advisable to use artificial intelligence at each of the above stages. For example, during tasks such as:
- development of project ideas (generation of new ideas for projects, analysis of their realism and potential benefit);
- creation of project questions (assistance to teachers in taking into account the individual needs and capabilities of applicants);
- formation of project teams (formation of project groups taking into account their competencies, interests and skills, etc.);
- search and analysis of information (quick and effective finding of necessary information for one’s projects, data analysis and drafting of conclusions), decision-making support

Fig. 1. The increase in the number of publications in Google Academy on the topic of using AI in the educational process

Sources: compiled by the author
(evaluation of various decision options and selection of the best of them);
- automation of routine operations (freeing up the time of applicants for more creative and intellectual work on projects);
- planning and monitoring project implementation (support in drawing up a plan (including defining goals, tasks, resources and time frames) and monitoring project implementation, as well as identifying potential problems);
- project implementation (assistance in performing various tasks related to project implementation (data analysis, modeling, optimization and visualization));
- project evaluation (automated evaluation of project results, identification of strengths and weaknesses, formulation of conclusions and recommendations);
- provision of personalized feedback (analyzing the work of applicants on projects and providing them with personalized feedback that will help them reflect).

The organization of the project activities of the applicants of professional preliminary higher education with the use of artificial intelligence involves defining the goals and tasks of the project; selection of appropriate artificial intelligence tools; training applicants to work with these tools; ensuring methodical support of project activities; evaluation of project results. Students can use AI tools like ChatGPT (or similar) to outline the necessary project components, offering an edge in their research journey.

Research is an important part of project-based learning, and artificial intelligence can greatly enhance and simplify this stage by organizing data and summarizing content. Tools like Genei and Google SGE can help students sift through information effectively, allowing them to focus on critical thinking and analysis. Effective management of team projects is crucial. Artificial intelligence applications such as Motion can automate the planning and prioritization of tasks, increasing team coordination and productivity.

When choosing artificial intelligence tools, the specifics of the project should be taken into account; the level of training of vocational pre-higher education applicants and available resources. We will provide some artificial intelligence web services for project training. For example, to generate texts (ChatGPT, Geminis, etc.), images (DALL-E 2, Leonardo.Ai, StarryAi, Lexica, Wombo Art, etc.), mind maps (Chatmind, Albus, etc.), presentations (Gamma.App, Tome, GPT-PP, etc.). For working with video and text, you should try Lumen5, Flipgrid, and for creating interactive exercises and tests – Yippity, Hotpot, etc. Various online generators (https://generator-online.com/uk/, https://uk.rakko.tools/), etc.) will come in handy for the implementation of project activities. The description of the use of generative artificial intelligence in educational activities is given on the platform, which is replenished with the appearance of new tools [6].

Useful for educators is MagicSchool, which offers more than 60 tools. The great thing about this app is that MagicSchool studies educational data to better understand teachers.

DISCUSSION
The integration of artificial intelligence into project education inspires innovation and creativity. Educators can use such technologies to explore new opportunities, experiment with new technologies, and develop creative solutions to real-world problems. Overall, AI-driven project-based learning is revolutionizing education by enhancing personalization, fostering critical thinking, encouraging collaboration, and stimulating creativity. With the power of artificial intelligence, teachers can create dynamic curricula that prepare students for success in a fast-paced world.

Along with the above advantages and prospects of using artificial intelligence in the project activities of the applicants of professional preliminary higher education, we observe certain challenges and cautions. First, it is important to observe ethical aspects and moral norms when using artificial intelligence, to treat copyright and personal information with respect. Secondly, it is necessary to develop the digital competence of students of professional preliminary higher education (ability to work with a computer, use Internet resources and AI tools, etc.). Thirdly, educational programs, syllabus, syllabi, educational and methodological materials should be adapted to the use of artificial intelligence in project activities, so that applicants can acquire the necessary knowledge and skills.

It is critical for students to understand the capabilities and limitations of AI tools, even as they are rapidly evolving. The challenge arising from the excessive or incorrect application of AI in the field of education is the need for critical evaluation of generated AI products and the principles of academic integrity when using them [4].

With the help of teachers, students can learn not to rely on AI, but to use it responsibly to support their learning, and teachers can demand transparency and accountability when students use these tools on their own [13]. It should be noted that we trained students of professional preliminary education to work with artificial intelligence tools with the help of master classes (VseOsivita, NaUrok), online courses (Prometheus, EdEra, Umity, etc.), watching webinars and independent study with the help of methodological recommendations and instructional cards.

CONCLUSIONS
Therefore, the use of artificial intelligence in the organization of project activities of students of professional preliminary higher education is a promising direction for the development of the educational sphere and has significant potential for increasing its efficiency and effectiveness.
Artificial intelligence can help improve the quality of education by improving the way teachers and students interact. It is likely that each teacher has the right to independently decide how to effectively and efficiently use this technology during education. It can help learners develop the competencies needed to function successfully in the information society, including critical thinking, creativity, communication, collaboration and teamwork, decision-making and complex problem-solving, and increase their motivation and interest in training. In addition, further research can be directed to the development of new methods and tools for the use of artificial intelligence in project-based learning, the study of its impact on various aspects of educational activities of students, as well as the study of ethical aspects of its use in education.

REFERENCES:


