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ARTIFICIAL INTELLIGENCE AS A PARADIGM IN UNIVERSITY EDUCATION: CHALLENGES AND SOLUTIONS

Abstract. *The article examines the problem of teaching artificial intelligence in universities, the difficulties of this process and ways to solve them. It is noted that the teaching of artificial intelligence in universities faces a number of problems. There is a shortage of qualified teachers in the field of artificial intelligence. The rapid pace of development of this field requires constant updating of educational programs and materials. The topic itself is quite technical and requires students to have a deep understanding of mathematical models, algorithms and programming. The difficulty of studying artificial intelligence at a university is the need for a wide range of knowledge and skills. Lack of practical experience of teachers and students of higher education, etc. Ways to solve the highlighted problems are proposed.*

Key words: *university, education, artificial intelligence training, students, knowledge.*

***Лубко Д.В. Штучний інтелект як парадигма університетської освіти: проблеми та рішення**. У статті розглядається проблема навчання штучного інтелекту в університетах, труднощі цього процесу та шляхи їх вирішення. Зазначається, що викладання штучного інтелекту в університетах стикається з низкою проблем. Не вистачає кваліфікованих викладачів у сфері штучного інтелекту. Швидкі темпи розвитку цієї галузі потребують постійного оновлення навчальних програм і матеріалів. Сама тема досить технічна і вимагає від студентів глибокого розуміння математичних моделей, алгоритмів і програмування. Складність вивчення штучного інтелекту в університеті полягає в необхідності широкого спектру знань і навичок. Відсутність практичного досвіду викладачів і здобувачів вищої освіти тощо. Пропонуються шляхи вирішення висвітлених проблем.*

***Ключові слова**: університет, освіта, навчання штучному інтелекту, здобувачі вищої освіти, знання.*

Introduction. As noted earlier: “Artificial intelligence (AI) is the science and technology of creating intelligent machines (software systems) capable of taking on certain functions of human intellectual activity (for example, choosing and making optimal decisions based on previously gained experience and rational analysis of external influences)” [1, p. 14; 2, p. 8].

In general, the relevance of this topic is primarily due to the following factors: insufficient number of qualified university teachers in the field of artificial intelligence; the rapid pace of development of this industry requires constant updating of curricula and materials; the topic itself is quite technical and requires students to have a deep understanding of mathematical models, algorithms and programming; the difficulty of studying artificial intelligence at university is the need for a wide range of knowledge and skills; heterogeneous level of student training; lack of Many domestic scientists are engaged in the development, study, implementation and popularization of intelligent systems and artificial intelligence in science and education, including the introduction into the educational process: Burdaiev V.P. [1], Vizniuk I. [2], Gagarin O.O. [3], Hlybovets M. [4], Dovbysh A.S. [5], Zaichenko Y.P. [6], Maryenko M. [7], Pchelyansky D.P. [8], Sharov S.V. [9; 10].

The purpose of the study. To analyse the study of artificial intelligence in universities, to consider the complexities of this process and ways to solve the problem.

Presentation of the main material. Teaching artificial intelligence at universities faces a number of challenges. First of all, the rapid pace of development in this area requires constant updating of curricula and existing equipment. The insufficient number of qualified teachers in the field of artificial intelligence is also a problem. To solve these problems, it is important to attract teachers with practical experience in the field, as well as to develop professional training programmes for academic staff. In addition, cooperation with industrial and scientific institutions can provide students with access to relevant knowledge and practical experience. The development of interactive learning materials and the use of new technologies, such as virtual reality or gaming platforms, can increase the effectiveness of teaching artificial intelligence. Such approaches will help to prepare qualified professionals who can meet the challenges of the modern labour market. An additional problem is the heterogeneity of the level of training of students studying artificial intelligence.

This is a challenge for teachers, who must ensure effective teaching of all students, regardless of their prior training and knowledge of the topic. To overcome this, an individual approach to each student can be used, as well as additional classes for those who need additional help. The development of adaptive learning systems and effective knowledge control can also help to solve this problem. In general, innovative teaching approaches aimed at combining academic knowledge with practical experience and individualised learning can ensure more effective teaching of artificial intelligence at universities. Another problem is the lack of resources to support AI infrastructure and laboratory workshops. This limits the opportunities for students to gain practical experience in applying AI tools and methods. To solve this problem, it is necessary to attract additional financial resources through cooperation with industrial partners, grant organisations, donors, etc. The development of virtual laboratories and online resources can also provide access to the necessary equipment and materials for AI training, even in the case of limited physical resources.

First, let’s analyse in detail the main disadvantages (difficulties) of teaching artificial intelligence at universities. The shortcomings of teaching AI

at the university can arise for various reasons, ranging from limited resources and equipment to shortcomings in teaching approaches. One of the shortcomings is the lack of relevant and practical knowledge among university teachers. As artificial intelligence is a dynamic field, not all teachers have the opportunity to keep up with the latest trends and technological innovations. This can lead to teaching outdated materials or lack of practical skills among students. Another disadvantage can be the complexity of the topic (AI) for students with different levels of training. Since AI combines concepts from many fields, from mathematics to computer science, it can be difficult for students to understand the material without a sufficient foundation in these areas. The third disadvantage is limited access to the necessary equipment and resources. Some universities may face financial constraints that make it difficult to provide students with the necessary computers, software, and access to other resources for AI training.

Some shortcomings may arise from ineffective teaching methods, such as the lack of active learning methods or insufficient attention to individual student needs. Taking these shortcomings into account and developing strategies to overcome them is an important part of improving the process of teaching artificial intelligence in university.

Another disadvantage of teaching AI in university is the lack of sufficient emphasis on practical aspects and real-world applications. Many courses can be focused on theoretical concepts and algorithms without providing students with enough opportunities to develop practical skills. This can result in students losing interest and being insufficiently prepared for real-world work in the AI field.

Another disadvantage is the lack of integration of AI into other subjects and disciplines. Artificial intelligence affects many areas of life, and the connection between it and other subjects, such as medicine, economics, or law, can be very important for a full understanding and use of this technology. The lack of such integration can limit the depth of students' understanding of the opportunities and challenges of AI in different fields.

Teaching artificial intelligence at a university offers many benefits to students that are also difficult to overestimate. Firstly, it gives students the opportunity to master modern technologies that are already being used in various spheres of life. The study of artificial intelligence helps students understand how algorithms, neural networks and other tools used to solve

complex problems in large companies, research and other industries work. Second, the study of artificial intelligence stimulates critical thinking and creative problem-solving. This field requires students not only to know the technical aspects but also to be able to apply them to create new solutions and innovations. Studying artificial intelligence helps students to develop analytical and creative skills, which is very important. Thirdly, teaching artificial intelligence at the university promotes the development of interdisciplinary connections. This field combines elements of mathematics, computer science, psychology, and other scientific disciplines. The study of AI stimulates cooperation between students and university lecturer from different specialities, which contributes to the expansion of their knowledge and universal development.

Another significant advantage of teaching artificial intelligence at a university is the stimulation of innovative thinking and support for student research. Studying this field gives students the opportunity to explore new ideas and develop their own AI projects. The university atmosphere is conducive to creative experimentation and the exchange of ideas, which can lead to innovative solutions and technologies. Studying this field requires students to analyse complex problems, develop algorithms and find effective solutions. This contributes to the development of their ability to think logically, to highlight the main points in the information flow and to make informed decisions based on available data.

It is also important to keep in mind that studying artificial intelligence at university contributes to the training of qualified specialists for the labour market. Graduates with knowledge and skills in artificial intelligence are very valuable in the labour market, as the demand for specialists in this field is constantly growing. Thus, teaching artificial intelligence at universities contributes to meeting the needs of the labour market and efficiently utilising students' talents.

An important advantage is the ability to realise potential and bring ideas to life. The study of artificial intelligence encourages students to think creatively and find new innovative solutions. They have the opportunity to develop their own projects, put them into practice, and participate in competitions and initiatives, which contributes to their personal development and encourages them to reach new heights in the field of artificial intelligence.

Next, we will analyse several important methods of improving student learning at universities when studying AI topics and areas. Improving students' learning at university when studying artificial intelligence can be achieved through the use of various pedagogical strategies and innovative methods. First, it is important to create a stimulating and engaging learning environment where students feel motivated and interested in gaining knowledge about artificial intelligence. This can be achieved through the use of interactive teaching methods, such as group discussions, projects, case studies, and practical tasks. Active involvement of students in the AI learning process helps to increase the level of learning.

Secondly, it is important to stimulate students' independent work and searching thinking. To do this, students can be given the opportunity to research topics of interest, search for information on the Internet, analyse their own data, and create their own AI-based projects and applications. Supporting such independent learning will help students develop critical thinking and problem-solving skills.

Third, it is important to create opportunities for the practical application of the knowledge gained. This can be achieved by organising labs, projects, and practical assignments where students can apply theoretical knowledge in practice and develop their AI skills.

Additional ways to improve student learning at university when studying artificial intelligence are the active use of modern technologies and information resources. For example, the use of video lectures, online courses, and interactive learning platforms can help students access diverse and up-to-date information. Such resources allow students to study the material independently at a time and pace convenient for them, which also contributes to their effective learning.

It is equally important to keep curricula and materials up-to-date with the latest trends in artificial intelligence. The use of the latest examples, cases, and applied tasks will help to stimulate student interest and maintain the relevance and depth of knowledge. Taking into account the above aspects and combining them in the educational process, we can create optimal conditions for effective AI training for students, which will allow them to develop successfully. In general, learning AI can enrich students' education by providing them with tools and competencies that can be useful in various related and unrelated fields and tasks.

Conclusions. To improve the process of teaching artificial intelligence at universities, innovative teaching approaches must be used. It is important to stimulate students' active participation in the learning process through the use of active learning methods, such as group discussions, projects, problem-based learning, etc. Interactive forms of classes allow students to learn more deeply and develop critical thinking. Another effective way to improve knowledge is to involve lecturers with practical experience in the field of artificial intelligence to teach courses and workshops. They can share their experience and practical knowledge, which enriches the learning process and makes it more practical. In addition, cooperation with enterprises and research institutions will allow students to organize internships and professional practice, which will help them gain the necessary practical experience and relevant competencies and skills.

It is very important that studying artificial intelligence at university can be a catalyst for further academic development of students. Students who are interested in this field can continue their studies at the master's and doctoral level, specializing in specific aspects of artificial intelligence. This can open up new opportunities for them in the scientific field, where they can make a significant contribution to the development of this field.

In general, teaching artificial intelligence at a university not only prepares students for the challenges of the modern world, but also stimulates their intellectual development and prepares them for future advances in technology. All these aspects should be taken into account when developing curricula and when students choose a path for self-study. The general idea is to create a comprehensive approach to the study of artificial intelligence by students that takes into account the needs and capabilities of students of different study areas.

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