

USING ARTIFICIAL INTELLIGENCE IN TEACHING COMPUTER SCIENCE IN HIGHER EDUCATION INSTITUTIONS

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Abstract

The article actualizes the problem of searching for new substantive directions for the development of the content of artificial intelligence training in the modern conditions of digitalization. The authors briefly describe the key technologies based on artificial intelligence proposed by the fourth technological revolution and leading to the digital development of the economy and society. Considering the main philosophical and ethical problems of artificial intelligence, as well as guided by the content of the Code of Ethics of Artificial Intelligence, the article proposes ideas and directions for designing a module for a course on artificial intelligence. The newly developed module, containing questions on the ethical problems of artificial intelligence, will not only aim to form certain competencies on this issue among students, but also to develop the content of artificial intelligence training at different levels of education, taking into account new trends in digitalization.

Keywords: digitalization, fourth technological revolution, convergent technologies, smart technologies, artificial intelligence, ethical aspects of artificial intelligence, Code of Ethics of Artificial Intelligence.

Introduction

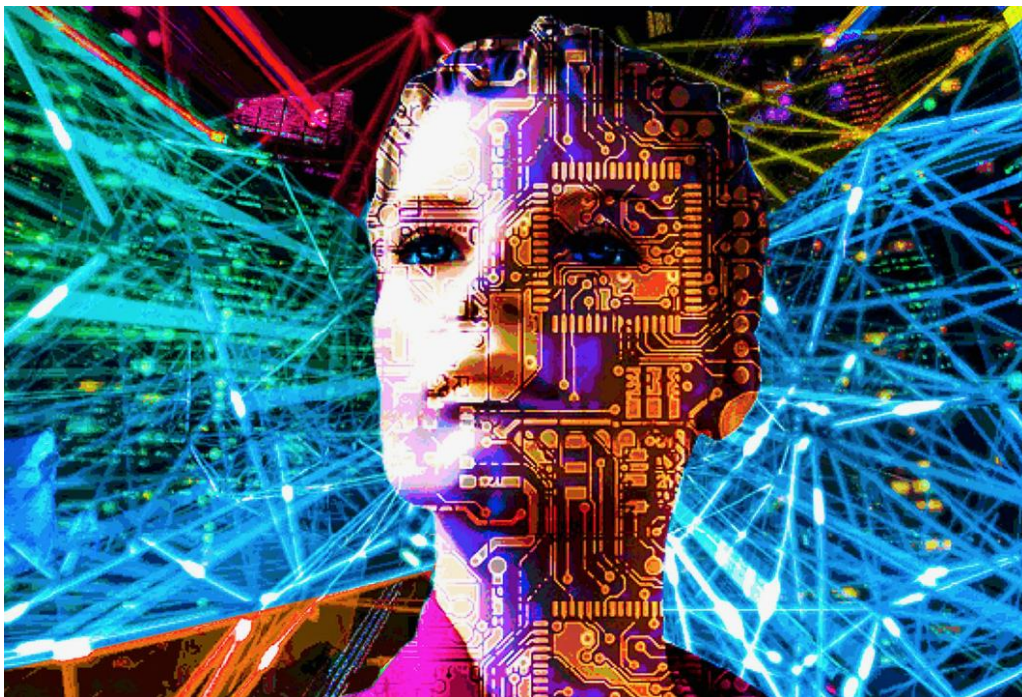
In the context of digitalization of modern society, in particular, such sectors as economy and education, artificial intelligence is becoming one of the basic trends in the development of technologies and components of the competencies of a modern specialist (including a teacher), as well as schoolchildren - future specialists for the digital economy.

It is this component of the development of modern society, dictated by the fourth industrial revolution, that is again becoming relevant today in the context of solving problems of various nature (both production and educational) thanks to the introduction of key digitalization technologies.

Let us stop and briefly describe those key technologies that are based on artificial intelligence to one degree or another and which modern specialists must master in the context of digitalization. It is generally recognized that the fourth industrial revolution [1], which has a systemic nature, causes not only the digitalization of the economy and public institutions, but also of the whole society as a whole, in other words, it brings society to a new level of digital development, where artificial intelligence (AI) becomes one of the basic foundations of its development. Despite the outstanding achievements in the field of this scientific knowledge and the development of AI technologies (both foreign and domestic), there is still no generally accepted and clearly formulated definition of the concept of "artificial intelligence". It remains "blurred" due to the



extensive listing of both technically complex and software-implemented properties and qualities of an artificially created object, which is ultimately endowed with artificial intelligence to solve a particular problem. Many definitions that exist today, starting from the luminaries of computer science and the founders of this branch of knowledge J. McCarthy and A. Turing, can perhaps be reduced to a primitive understanding of its essence, formulated back in 1956 at the Dartmouth Conference of Cognitive Scientists. Reflecting on the problems of creating "smart" machines that work and make decisions like people, J. McCarthy proposed to interpret AI as "a way to make a computer, a computer-controlled robot, or a program that can also think intelligently like a person." Summarizing the current views and retelling the published materials on AI, we can confidently write that AI is a variety of applications (programs) for computers that "understand" human language and act as virtual personal assistants, can play various intellectual games (like chess) against people, etc. AI is also computer robotics that sees, hears and responds to sensory stimuli. AI is the introduction of digital technologies into various socio-economic sectors of modern society, based on its (AI) technical means and principles, leading to a significant reduction in waiting time and receipt of various social services through the use of search services and modern databases - information systems. It is no longer uncommon today that there are AI-based technologies that have been able to surpass human capabilities in various areas of human activity, including professional ones. For example, image recognition systems — "computer vision" or "smart eye" — are becoming so much more precise due to their technical development that they can detect given objects among a mass of others like them better than humans. Speech recognition systems are already capable of analyzing telephone conversations and voice recordings at a level that matches human capabilities. AI also influences the development of education, medicine and healthcare, public administration and banking, which entails their digitalization and the emergence of "smart" assistants in one or another professional field (smart education, smart medicine, etc.).



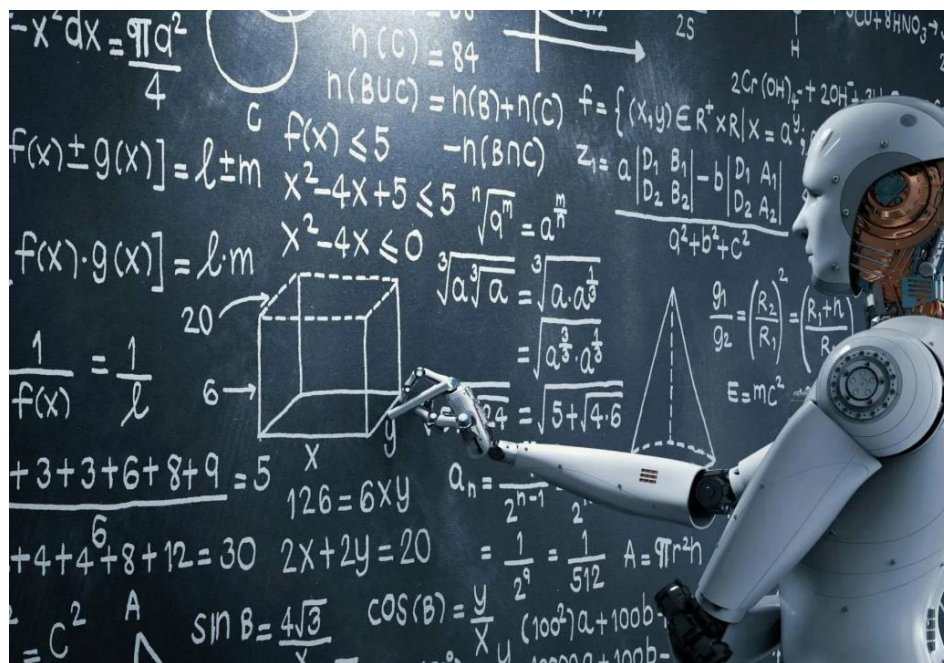
For example, B.G. Ivanovsky in his article devoted to the analysis of this issue, formulating the economic effects from the introduction of "artificial intelligence" technologies and referring to various foreign and domestic analytical data, writes: "It is predicted that AI technologies will lead in the future to significant economic shifts caused by the growth of labor productivity due to the use of machines that are capable of performing new functions (driverless cars, advanced robots, "smart" assistants to support people in their daily lives, etc.)". According to many modern analysts, philosophers and computer scientists [1-3], it is AI that will make it possible to "turn" the economy (in particular, the production of consumer goods) "to face the person". In other words, relying on the works of K.M. Schwab [1], it can be argued that thanks to the introduction of technologies of the fourth industrial revolution (for example, artificial intelligence), individualization and even personification of production will become possible, which will entail a significant economic effect. In particular, as noted by B.G. According to Ivanovsky, citing foreign and domestic analytical sources, "economically developed countries can additionally receive from 20 to 25% of net economic benefit by 2030 due to the development and implementation of artificial intelligence technologies. The economic effect of these forms of investment (excluding capital investments in AI) will amount to from \$359.6 to \$773.2 billion over ten years." The key technological element that has emerged in the context of the formation of a digital society thanks to the fourth industrial revolution based on artificial intelligence tools and technologies are "smart" technologies and the Internet of Things technology.

Note that striking examples of "smart technologies" (already implemented in the everyday life of modern society, as already briefly noted above) are "smart home", "smart city", "smart technologies", "smart medicine", etc., which today are generally recognized elements of a "smart virtual society" based on an intelligent infrastructure. Another significant technology of the digital society is 3D printing technology, which is also based on artificial intelligence. Modern analysts predict that over time, when more than 5% of all consumer goods, including personalized ones, will be produced using 3D printing, a turning point will come in the economy of the digital society, which will certainly affect the minimization of the delivery of goods. As part of the digitalization of modern society, many projects are actively being implemented related to the introduction of artificial intelligence technologies in various areas of human life. For example, according to information published on the website "Artificial Intelligence in Uzbekistan: State of the Industry and Forecasts" and also according to the international consulting company J'son & Partners Consulting, "in the Republic of Uzbekistan, about 200 companies are engaged in the implementation of artificial intelligence technologies and work with virtual and augmented reality systems, in particular, the Sberbank Corporate University, the Skolkovo Innovation Center, the Bortnik and VRTech funds, an open community of business representatives and individuals in the AF/VR industry - the Augmented and Virtual Reality Association and others." In addition, as noted by many analysts (see, for example, articles on the portal "TAdviser: State. Business. Technologies", which presents, among other things, materials from the largest IT companies in Uzbekistan), as well as by us in one of our works devoted to the problems of virtual reality and its use in education [5], the main representatives in the market of augmented and virtual reality technologies are the national companies Fibrum (the creator of helmets for augmented and virtual reality) and Nival (the creator of virtual reality games).



In educational organizations, both for traditional and distance learning, today, methods and technologies based on virtual or augmented reality are actively used. Among them, online courses on training in the creation of applications that implement virtual reality are becoming especially popular. For example, in the direction of training bachelors in "Informatics and computer engineering", the university offers the focus (profile) "Virtual technologies and design".

In educational programs of higher education, training in augmented and virtual reality technologies can be presented in the form of separate modules or disciplines, such as "Development of gaming applications". Technology companies are also not standing aside, not only developing their own developments on this issue, but also using their platforms for training (for example, the company Eligo Vision and its development - the EV Toolbox platform) both themselves and providing them to other educational organizations within the framework of cooperation.



When speaking about the key technologies of digitalization dictated by the fourth industrial revolution, it is impossible not to mention convergent technologies, which are closely related to the means and technologies of artificial intelligence, including a cognitive component. According to discussions of modern philosophers, convergent technologies (information and communication, biotechnology, cognitive and nanotechnology) represent a new priority direction in modern scientific philosophical knowledge and in the development of technologies in the context of digitalization. In a broad sense, as V.I. Arshinov points out, this type of technology is based on the understanding of the convergence of knowledge and technology "as a process of escalation and transformation among seemingly different scientific disciplines, technologies, communities, different areas of human activity with the aim of achieving mutual compatibility, synergy and integration...". In addition, convergent technologies play an important role in solving the problem of "technical improvement of humans", which directly relate to philosophical and ethical issues, including artificial intelligence.



In this context, we will list 9 main ethical problems of artificial intelligence, according to Julia Bossmann, president of the Foresight Institute, which is based in Palo Alto, researches and promotes transformative technologies.

- 1) Unemployment. What will happen with the extinction of professions?
- 2) Inequality. How do we distribute the benefits produced by machines?
- 3) Humanity. How do machines affect our behavior and interactions?
- 4) Artificial stupidity. How can we protect ourselves from errors?
- 5) Racist robots. How can we get rid of the bias of artificial intelligence?
- 6) Security. How to keep artificial intelligence safe from adversaries?
- 7) Evil geniuses. How can we protect ourselves from unwanted consequences?
- 8) Singularity. How can we control a complex smart system?
- 9) Robot rights. How do we define human attitudes towards artificial intelligence?

These issues, formulated as problematic questions, are in some sense generally accepted. According to such tech giants as Alphabet (Google), Amazon, Facebook (the social network is recognized as extremist), IBM and Microsoft, as well as individuals like Stephen Hawking and Elon Musk, now is the right time to discuss the almost limitless landscape of artificial intelligence, which is almost as much a new frontier for ethics and risk assessment in the digital era as it is for new technologies.

It is important to understand that in the context of the development and synthesis of information, digital and cognitive technologies, as well as their comprehensive implementation in all spheres of human activity, the formation of a modern digital society will entail irreversible changes not only in the technological, economic and social spheres, but also in all types of professional human activity. As a consequence, certain transformations of the personality of a modern person will be inevitable.

In addition, today it is not only appropriate to state the penetration of “smart”, cognitive technologies into the field of education within the framework of its digitalization, which are based on technologies and means of artificial intelligence, but also to talk about the relevance of searching for new aspects of developing the content of teaching artificial intelligence both within the school computer science course and within the framework of extracurricular activities. Let us turn to and briefly describe the existing empirical experience of teaching the basics of artificial intelligence at school, taking into account our own experience.



For the school education system, this direction in training is not fundamentally new, although it has not received wide distribution in practice, including in computer science lessons. At one time (2010), I.G. Semakin and L.N. Yasnitsky, leading scientists and specialists in the field of school computer science and artificial intelligence, expressed the need to study the topic of artificial intelligence in the general education course of computer science at an introductory level, the authors presented the following content: "Artificial intelligence: history of development, areas of application, knowledge models and expert systems, neurocomputers and neural networks", in the practical part, the students' work is based on the use of ready-made neural network models and demo versions of expert systems. It should be noted that at the basic level in computer science textbooks for secondary school (I.G. Semakin), attention is paid to the direction of knowledge modeling and the idea of expert systems. For pre-professional training of schoolchildren within the framework of specialized computer science training in senior grades, an elective course "Artificial Intelligence" (2012) developed by L.N. Yasnitsky and F.M. Cherepanov is proposed. The authors created a textbook for schoolchildren, a methodological manual for teachers and a computer workshop with a system of laboratory work from studying the mathematical model of a neuron and modeling logical functions, the perceptron model and character recognition to studying neural networks and their application in solving individual practical problems. For an in-depth level of studying computer science at school, curricula and textbooks have currently been created, for example, I.A. Kalinina and N.N. Samylkina [17], which include artificial intelligence issues in the content of training within individual topics in high school. A large number of educational projects and programs for schoolchildren have appeared on the part of large companies such as Sber and Microsoft, for example, the project "Academy of Artificial Intelligence for Schoolchildren", the module "Machine Learning and Big Data" for general education. The AI Academy offers introductory lessons on the role of artificial intelligence, machine learning and the profession of Data Scientist, as well as a long online course on Machine Learning for schoolchildren, competitions and Olympiads on Artificial Intelligence. The educational module on Machine Learning, created on the Microsoft educational platform, introduces schoolchildren to Big Data technology and individual machine learning algorithms, their implementation within the framework of studying ready-made available data sets. Students implement three educational projects, such as, for example, forecasting credit risk; for practical work within the projects on the Microsoft Azure portal, two cases are presented: on calculating the price of a car using a ready-made dataset and on predicting the experience of a player in Dota 2 using a dataset. The widespread use of modern technologies using intelligent algorithms and Big Data, the expansion of educational materials for schoolchildren, create conditions for updating approaches to teaching artificial intelligence issues in the school computer science course. But in this context, we must not forget about the philosophical and ethical problems of artificial intelligence and find in the content of artificial intelligence training worthy attention to these issues both in depth and in the breadth of their conceptual content. Thus, in our opinion, there is an actualization of the need to develop a special module on the ethical problems of artificial intelligence. At the same time, the main elements of the content for this module can be implemented on the basis of ideas that can be obtained through interpretations of the above problematic issues - 9 main ethical problems of artificial intelligence, for example, according to J. Bossmann, as well as based on the content of the Code of Ethics of Artificial



Intelligence of the Russian Federation, which was developed with the participation of more than 500 experts and publicly presented on October 26, 2021 at the international forum "Ethics of Artificial Intelligence: the Beginning of Trust" with the support of the Government.

It should be noted, based on publications, that this forum became the first specialized platform in Uzbekistan for developing principles of artificial intelligence (AI) ethics. The participants of the event, including representatives of federal and regional authorities, businesses, public figures and experts, not only discussed the existing problems and possibilities of AI influence on traditional spheres of life and the risks associated with its use and implementation, but also took part in the ceremonial signing of the AI Code of Ethics, developed taking into account the requirements of the National Strategy for the Development of AI for the period up to 2030. The authors of the code are the Alliance in the Sphere of AI together with the Analytical Center and the Ministry of Economic Development. The document will become part of the federal project "Artificial Intelligence" and the Strategy for the Development of the Information Society for 2017-2030, which enshrine the basic principles of life in a new reality in which a person is surrounded by robots. In this context, we will quote the Deputy Prime Minister, who, speaking at the forum, said: "AI technologies are gradually being introduced into a variety of areas of life, including education, healthcare, and public administration. According to surveys, about 48% of people trust AI. This is a fairly high figure. But part of society still has an ambiguous attitude towards such technologies, and this is what we need to work on. Society needs reliable AI with a lower error rate than humans. The rights and freedoms of citizens are guaranteed by the Constitution. Our responsibility is to implement mechanisms to protect them regardless of the environment in which a person is located. Compliance with ethical standards when working with AI will prevent their violation, so the government welcomes the signing of the AI Code of Ethics by the professional community, which will increase the level of public trust in new technologies. Based on best practices, Uzbekistan is among the top ten countries for which the ethical development of the most important technology of the 21st century is of national importance." Thus, the Code of Ethics in the field of AI today regulates the moral and ethical side of the use of this technology, proclaims a human-oriented, humanistic, risk-oriented (correlating the severity of regulation with the potential impact of the created systems) approaches to the development of AI technologies, precautionary principles and a responsible attitude of actors to the issues of the impact of AI systems on society and citizens, preventing discrimination from AI, causing no harm, data security and information security, identifying AI in communication with a person and respecting the autonomy of the human will, responsibility for the consequences of using AI. It is assumed that the code will become a framework element of self-regulation for developers of AI technologies. In conclusion, we note that the idea of writing this article was born as a result of professional communication on this issue with colleagues - teachers and lecturers of pedagogical universities and school teachers of computer science, as well as thanks to the analysis of the experience gained as a result of holding the first AI Olympiad among students in grades 8-11 of general education organizations. The Olympiad was held in accordance with the requirements for the results of mastering the main educational programs in the subject area "Mathematics and Computer Science" (advanced level), established by the Federal State Educational Standards of Basic and Secondary General Education and provides advantages when entering universities. It is planned that the Olympiad will become a regular



event, implemented within the framework of the federal project "Artificial Intelligence" of the national program "Digital Economy". To summarize, we believe that the material of the article will be useful to a wide range of the pedagogical community for using it in the practice of teaching computer science to both modern schoolchildren and students of non-core universities studying artificial intelligence. The material presented above is of particular importance for teachers and lecturers of computer science (at least in terms of familiarization), for example, with the content of the Code of Ethics of Artificial Intelligence recently adopted in the Russian Federation. Moreover, this regulatory document acts here as a source for the development of the content of teaching philosophical and ethical problems of artificial intelligence, which today, unfortunately, are not given enough attention in the course of computer science.

REFERENCES

1. Abdullayeva, G. (2022). Methodological competence of university teachers in the context of inclusive education. *Solution of social problems in management and economy*, 1(6), 58-65.
2. Abdullayeva, D. (2021). Formation of gender identity in the process of socialization. *UzMU Xabarlari*, 1(6), 65-68.
3. Bektemirova, B. B., & Saidjalilova, D. D. (2023). The importance of connective tissue dysplasia in pathological conditions in obstetrics and gynaecology. *Образование наука и инновационные идеи в мире*, 14(2), 44-52.
4. Akbarova, N., Gaponov, V., Shipulin, Y., Azamatov, Z., & Majidova, G. (2023). Method for measuring the elasticity of materials. *Science and innovation*, 2(A9), 151-158.
5. Eshnazarova, M. (2023, May). *Xorijiy tilni mustaqil o'rganishda mobil texnologiyalarning o'rni*. International Scientific and Practical Conference on Algorithms and Current Problems of Programming.
6. Israil, M. I., & Erdonova, M. (2024). Translation problems of proverbs from English into Uzbek. *Новости образования: исследование в XXI веке*, 2(21), 385-390.
7. Исроилов, М. (2024). Тил Ва Жамият Ўртасидаги Муносабатлар: Социоллингвистик Таҳлил. *Miasto Przyszłości*, 46, 266-270.
8. Вахромовна, В. М. (2024). Та'лим jarayonida qo'rquvni bartaraf etishga innovatsion yondashuv. *TADQIQOTLAR. UZ*, 49(3), 13-19.
9. Бадритдинова, М. Б., & Тургунпулатова, М. (2023). Психологические особенности развития познавательного стиля в образовательном процессе. *Образование наука и инновационные идеи в мире*, 16(1), 25-29.
10. Alisherovna, M. N., & Tokhirjonkyzy, G. G. (2020). The professional development of teachers of primary education, improvement of the professional qualifications and skills. *Asian Journal of Multidimensional Research (AJMR)*, 9(3), 87-91.
11. Makhmudova, N. A. (2019). THE ROLE OF INNOVATION IN PRIMARY EDUCATION. *Scientific Bulletin of Namangan State University*, 1(11), 298-301.
12. Halimjanovna, A. M., & Baxromovna, B. M. (2023). Muammoli ta'lim mustaqil fikrlash omili sifatida. *Science and innovation*, 2(Special Issue 14), 266-270.



13. Xalimjanovna, A. M. (2022). Raising a Child and Preparing Him for Social Life in the Works of Our Great Scientists. *EUROPEAN JOURNAL OF INNOVATION IN NONFORMAL EDUCATION*, 2(5), 38-41.
14. Фаизова, Ф. Ш. (2021). Вопросы изучения статейных списков. *Н34 Наука и инновации в XXI веке: Материалы Международной*, 126.
15. Alimova, F. O. (2023). Medicinal plants of the lamiaceae family in folk medicine of Uzbekistan. *European Journal of Interdisciplinary Research and Development*, 11, 5-7.
16. Mirsalikhova, N. H., Shamsiev, F. M., Azizova, N. D., & Nurmatova, N. F. (2021). Predictive significance of nitrogen oxide in community-acquired pneumonia associated with TORH infection in children. *湖南大学学报 (自然科学版)*, 48(7).
17. Axmedov, B. A., & Muxamedov, G. I. (2021). Klaster Mobile DGU 09834.
18. Akhmedov, B. A. (2023). Use of information technology in medicine, history, biology, literature, physical education. *Uzbek Scholar Journal*, 22, 17-29.
19. Inomjonov, N., Axmedov, B., & Xalmetova, M. (2023). Kasbiy faoliyatida axborot-kommunikativ kompetentlikni oshirish usullari. *Academic research in educational sciences*, 4(CSPU Conference 1), 580-586.

