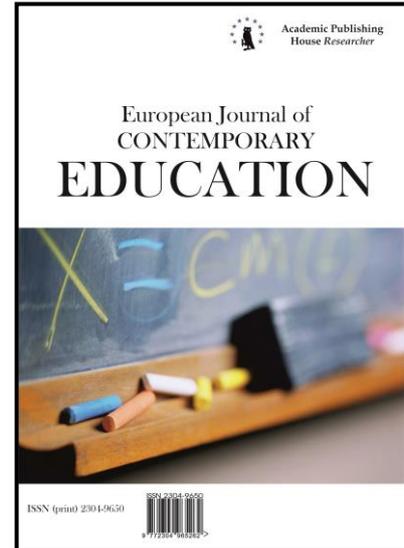




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## Digital Technologies and Artificial Intelligence Technologies in Education

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### Abstract

The current stage of society development is very closely related to the digitalization of all spheres of public life without exception. Education in this regard should become the starting point or the basis for the competent and conscious application of Artificial Intelligence (AI) technologies, neural networks, and other cyber-physical systems based on AI, as well as robots and robotics objects. Digitalization in education is promoted by economic, social and structural prerequisites. The introduction of these technologies provides new opportunities to improve the educational process, but at the same time the application of these technologies faces some risks, the identification of negative consequences of which is delayed. The aim of the article is to provide the ways for the development of legal regulation of AI, robots and robotics objects in education. The study considers the experience of different countries in the implementation of AI technologies in the educational process, provides the opinions of international UNESCO experts, Russian and foreign researchers. According to the results of the research, three main directions of the relationship between the development of AI technologies and education are identified: 1) training with the help of AI technologies; 2) scientific and practical research of AI and its technologies; 3) training qualified specialists to work with AI in the process of obtaining secondary and higher education. The factors that hinder the implementation of these technologies, as well as the risks of negative consequences of their use in the form of violations of the students' rights are revealed. Findings and proposals for each of the identified areas are formulated.

**Keywords:** legal regulation, digital technologies, artificial intelligence, education, ICT competencies, aspects of the educational process.

### 1. Introduction

New technologies, usually described by the general term 'Artificial Intelligence (AI)', are becoming more common in human society. They are developing rapidly and affect almost all aspects of our life: autopilots, telemedicine technologies, chat bots, Big Data, smart cities, smart

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homes, automated surveillance methods, artificial intelligence technologies in weapons, cyber justice, etc. Artificial Intelligence is revolutionizing financial services with applications ranging from fraud detection, tax evasion or money laundering to regulatory technologies that improve regulatory processes such as monitoring, reporting and compliance. Neural networks based on the concept of data analysis allow obtaining a huge amount of information in a short period of time, which is used in the education system.

At the present stage of the development of the global educational environment, the use of national virtual learning university programs for the export is no longer an additional server for the development of a specific institution of higher education, but a separate significant constituent of the content development of the provided educational programs, university management and various aspects of the learning process itself. This makes it possible to combine digitalization of education in various configurations (Bruhn, 2020: 20-21; Frolova et al., 2020, Frolova et al., 2021), information and communication technologies (ICT), including using artificial intelligence technologies (Popova et al., 2021a; Popova et al., 2021b) and online internationalization in universities. ICT is gaining in importance, and as a result, each university offers its own content, which differs in countries conventionally related to the "west" and "east".

## **2. Materials and methods**

The use of AI in various spheres of society is a reality in most advanced economies. The education sector cannot stay away from the use of digital technologies and artificial intelligence technologies in the educational process. The modern scientific literature presents research results of the possibilities and effectiveness of the use of such technologies in certain segments of educational services (Frolova et al., 2021; Gómez-Galán et al., 2021; Sirotova, Michvocikova, 2021; Morozova et al., 2020). The authors of the article conducted scientific research aimed at examining the positive and negative aspects of using AI.

The authors used a complex of general scientific and specific scientific research methods: a comparative legal analysis of scientific literature, legal and other documents on the topic of research to prove the hypothesis proposed in the article about the need for a balanced use of digital technologies and AI technologies, taking into account ethical and legal principles that do not violate the rights of participants in educational process in different states (UNICEF Innovation, 2020).

Particular attention was paid to the sociological methods of conducting scientific research. When writing the article, the results of a research were partially used, in which students and postgraduates of the country's leading universities, studying in various educational programs (jurisprudence, management, economics, finance, law enforcement agencies, applied informatics, etc.) took part. In total, 360 respondents were interviewed, who were asked to answer a number of questions related to the use of online technologies in educational activities. The survey was conducted on the google.com/forms platform in January 2021 wherein a non-random sample was used. The questionnaire was purposefully disseminated through the corporate mail of universities, in social networks among student, postgraduate and teaching associations, and WhatsApp and Telegram messengers were also used. The respondents were asked to take an anonymous survey, which included 23 questions. The processed results of some of them are given in the study. Of the respondents: bachelor students accounted for 64.7 %, specialty students 10 %, masters 8 %, graduate students 17.3 %. The specified sample set, in general, reflects the parameters of the general aggregate of persons receiving higher education, with the exception of the percentage of postgraduate students who expressed a desire to take part in the survey, which may indicate their higher activity and interest in participating in scientific research.

## **3. Discussion**

In the scientific studies by the Russian and foreign researchers there is a significant number of works devoted to AI (Neznamov, Naumov, 2018; Tononi et al., 2016; Chelioudakis, 2019; Akyuz, 2020; Kashive et al., 2020) and the use of its technologies in various spheres of society (Morkhat, 2017; Bortalevich et al., 2019; Acosta, 2019; Rolinson et al., 2018; Barakina, 2021; Gorokhova, 2020; Rashid, 2019; Akinrinola et al., 2019). Researchers in the field of AI identify several areas of its use in education (Nosov, Sokolov, 2016; Purnova, Zaripova, 2019; Paskova, 2019; II v obuchenii, 2021; Gómez-Galán et al., 2021; Mohammed, Watson, 2019; Feng, Law, 2021). The central place in the introduction of AI technologies in education is occupied by teachers, because the correct choice

of training tools and the effectiveness of the use of AI depend on them (Kalinina, 2018; Dendev, 2013: 72; Grishkun, 2018; Bali, 2017; Luckin et al., 2016: 25; Schiff, 2021). In the supranational regulation system of the use of digital technologies and AI technologies, UNESCO documents are of particular importance; this organization monitors the education sector using the education management information system (EMIS, 2021).

At the national level, there is a gradual transformation of the education system taking into account the application of such technologies. The application of neural networks within the educational process is known in China; besides other functions it includes the assessment of tests (essays). Such AI-based neural networks, using deep learning algorithms, evolve at such a rate that it is impossible to predict by what criteria the network provides its checkup and what grade the student will receive as a result (Chen, 2018).

Since 2018, "virtual instruments" in education have been widely used in Latin American states at the level of government initiatives (Sunkel, Trucco, 2012). For example, Uruguay is using an online adaptive learning solution called 'Mathematics Adaptive Platform', which provides personalized feedback based on the analysis of student work according to the level of knowledge of each student (Perera, Aboal, 2019). A similar system called 'MECFlix' operates in Brazil (MECFlix, 2021). The relevant ministry of the government of the United Arab Emirates has developed special machine learning algorithms for the development of strategic research of the educational system of the state (Leading Countries, 2018). Another example of the use of AI technologies in research and forecasting for the sustainable development of the national education system is the experience of Chile (AI in Education, 2021).

The international initiative UNICEF Innovation (UNICEF Innovation, 2020) is studying the potential of deep learning algorithms when used in various countries jointly by academic staff of universities and business communities. Based on the results of various studies in this area, a Memorandum on AI and the Rights of the Child was created (Memorandum on AI, 2019), which summarizes examples of the positive and negative impact of digital technologies and AI technologies on children in the learning process.

#### **4. Results**

The development of the information society is based on two main components: information and knowledge (Toffler, 2009). Digital technologies, including artificial intelligence technologies, can significantly help reveal human potential in the new conditions of combining virtual and everyday realities. The transformation of education is not only a consequence of the development of social relations, but also a factor in their change and subsequent impact on society in the era of the 4th scientific and technological revolution. The changes in the paradigm of the social relations development described by Thomas Kuhn (Kuhn, 2012: 78) were illustrated by him precisely by the example of the student's participation in the educational process as a starting point for subsequent transformations.

According to UNESCO experts, AI has the potential to solve some of the biggest challenges in education, in innovative teaching and learning practices, and ultimately in accelerating progress towards Sustainable Development Goal 4 (SDG 4). However, these rapid technological changes inevitably lead to multiple risks and challenges that have so far outstripped political debate and regulatory frameworks (AI in education, 2021).

For example, since 2001 innovative e-learning technologies have been widely used in Malaysian universities, where all students get access (at home, at work or in a computer class) to the university's online resources and an electronic library; to the latest educational digital technologies (in-classroom learning, online distance learning and blended learning). The blended learning methodology of the integrated education strategy combines approaches such as executive coaching; participation in an online class; breakfast with colleagues and classmates; outside reading in nature; participation in seminars, workshops and online communities, implementing social interaction, cognitive development and interpersonal dialogue (Sultanova, 2015: 665). Education in universities takes place online or through a web interface-mode, completely replacing classroom studies, in accordance with the university's strategic plan for the implementation of the "electronic university" project (Sultanova, 2015: 663-664).

This principle is followed by Open University in Great Britain, UNISA (University of South Africa), Korean National Open University, Indira Gandhi National Open University, Hong Kong

Open University, Open University of Malaysia, Multimedia University and CyberCity (Cyberjaya) University Tun Abd Razak (UNITAR) virtual universities in Malaysia, etc.

Today, almost all researchers in the scope of virtual education consider both digitalization and the widespread use of AI technology to be among the most important trends in the development of modern higher education. Thus, the European University Association (EUA) (Gaebel, 2018) defines digital learning as the central strategy of European universities. A special study “Internationalization of Higher Education” commissioned by the European Parliament identifies digital learning among ten key trends in national strategies for internationalization (de Wit et al., 2020: 27).

Scientists and specialists in the scope of higher education agree that profound social changes associated with digitalization and the use of AI in terms of information and communication technologies are transforming higher education, they call this phenomenon a “digital turn” (Bruhn, 2020: 23; Frolova et al., 2021: 49-50). Thus, AI technologies are tools introduced and used for training, which allow analyzing the results obtained, identifying problems and risks in order to spread good practices and to level the negative consequences (Leading Countries, 2018).

The use of digital technologies and AI technologies in the educational process can be conditionally divided into three areas: learning, practical research and training for the AI application (AI in education, 2021). The authors of this scientific article support this point of view and reveal possible ways of developing these technologies in these areas.

I. Learning with the help of AI technologies, which, on the one hand, is a toolkit for a wider use of these technologies by students in various spheres of public life, on the other hand, the result of studying various academic disciplines that consider AI and preparation for interacting with it. The digitalization of the educational process is transforming the model of practical pedagogical activity, and there appear such concepts, as digital didactics, electronic information and educational environment, electronic pedagogy.

The use of AI technologies can represent a special system of pedagogical and methodological tools, with the help of which not only the solution of educational problems is achieved, but also a change in the roles of participants in the educational process, when the student becomes a teacher (i.e., partially independently makes decisions on the organization of an individual educational trajectory). The structure of the entire education system is also changing, the center of which is no longer the teacher, but the student, and the entire educational process depends on the level of his knowledge and competences. In order to create a motivational environment, open educational resources are used not only of universities, but also of scientific and university consortia, electronic libraries, network universities and blended learning (Chankseliani, 2017).

II. Scientific and practical research of AI technologies is, on the one hand, the development of approaches and methods that can serve as a basis for its application in the educational process and other spheres of public life, and, on the other hand, the result of preparation for AI and, accordingly, for the process of learning using these technologies. They can address the challenges of personalizing and improving learning outcomes and analyzing and managing education data.

Increasing the personalization of the educational process is one of the most anticipated innovations in this area. The representatives of Alpha generation will learn almost exclusively with AI technology. This generation has, like other generations, distinctive characteristics that must be taken into account when developing and implementing tools for training. Changes in educational interaction are happening for Z generation and the next generation Alpha in schools, that is, the transition from structured and auditory learning to the attraction of visual, multimodal and practical teaching methods of these new generations (Education, 2021; Eskindarov, 2021). In addition, when studying AI technologies, special attention should be paid to the delayed effect of the psycho-emotional development of the student, as well as possible violations of their rights, since the educational process is not only the achievement of the goals of the program and the teaching of specific skills, but also the process of forming a personality, a member of society.

III. Training qualified specialists to work with AI in the process of obtaining secondary and higher education, within which all individuals are given the opportunity to better understand the impact of digital technologies and AI technologies on human life, is a well-known result of learning with the help of AI and training qualified personnel to interact with it. Preparation for the use of AI begins not just with the process of training students, but with training teachers the skills of applying innovative technologies in the educational process. It is the teacher, his knowledge,

his ability to teach the use of technologies, including AI technologies, will become the basis for providing all citizens with the opportunity to better understand the potential impact of AI on human life. In order to prepare for the use of AI technologies, the teacher must master a set of knowledge and skills. UNESCO specialists have formed a matrix of the structure of teacher's ICT competencies (UNESCO Recommendations, 2011). Three approaches were proposed in the matrix: the use of ICT, the development of knowledge, the production of knowledge, which are actually stages of the development of the teacher's ICT competencies in the future information society, in general, and education, in particular.

The most famous model is the SAMR (Substitution, Augmentation, Modification, Redefinition), which was created by Ruben R. Puentedura at Harvard University for teachers of different levels of education (from elementary school to university) in the choice of information technologies and their integration. They were offered four levels of such integration: (1) "Substitution" – students' choice of new technologies for self-training and work in the format of teachers; (2) "Augmentation" – the use of simulators and other innovative technologies to study academic disciplines; (3) "Modification" – the use of digital technologies and AI technologies to build an individual educational trajectory; (4) "Redefinition" – the use of new technologies for their own project activities, the creation of digital artifacts, online commenting, etc. (Hippasus, 2021). There is also a lot of research on the integration of Bloom's model and taxonomy (including "digital") (Anderson et al., 2020), the meaning of which is that the level of use of information technology should be associated with the achievement of specific educational goals (Figure 1).

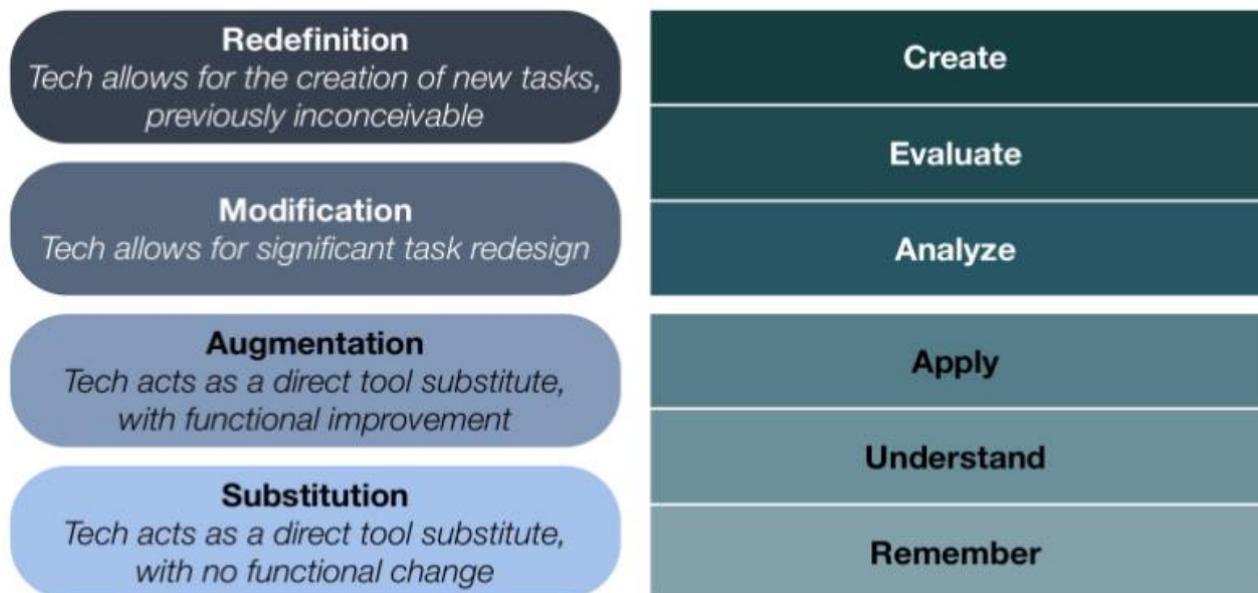


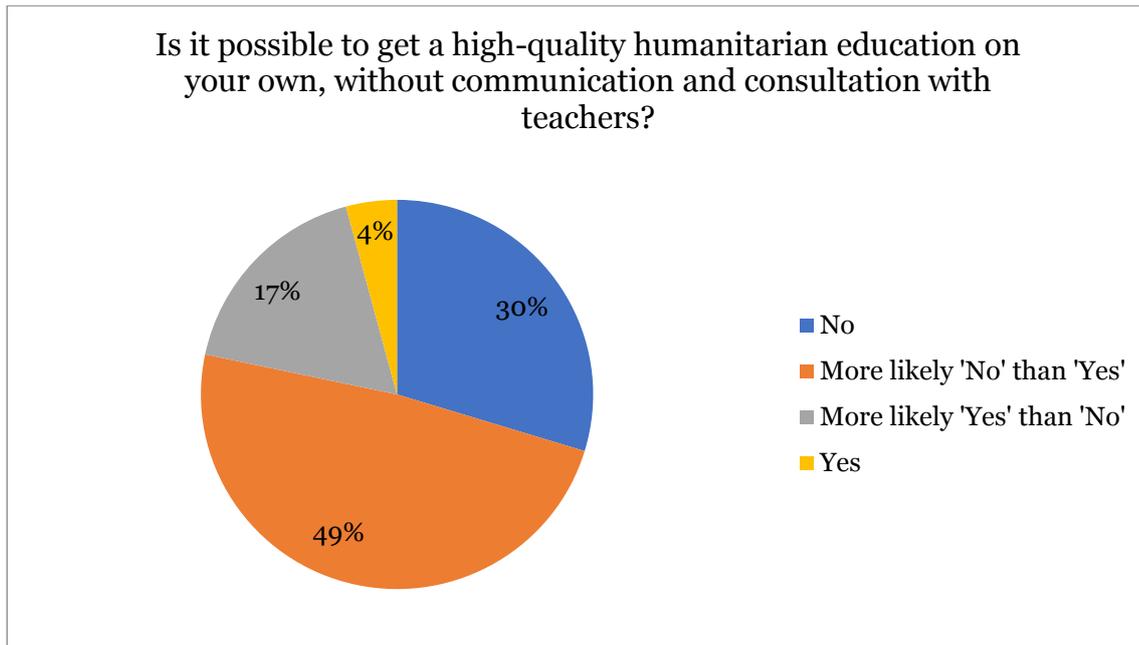
Fig. 1. SMAR and Bloom taxonomy levels (Bugaichuk, 2017)

It should be noted that these areas (learning using AI technologies; scientific and practical research of AI and its technologies; training qualified specialists to work with AI) should be considered only in conjunction, since they indicate both the influence of AI technologies on the education system (not only at the national, but also at the global level of education) and the peculiarities of the ontological perception of AI itself in each country (Popova, 2021a; Popova, 2020; Ruchkina i dr., 2020).

The use of innovative technologies, including digital technologies and AI technologies in the learning process, transforms the role and place of the teacher, changes the goals of the educational process while setting new tasks. The UNESCO recommendations (First ever consensus on AI, 2019) in education not only actually unite all levels of the educational process but also may be considered to be the principles, according to which the concept of introducing and applying AI technologies in the education system of each country should be formulated. These recommendations can become the basis for national strategies for the development of education, and, therefore, will ensure mutual

implementation in the development of approaches and the use of AI technology tools in the educational process in the context of digitalization of public relations.

Despite the development of digital technologies and AI technologies in the educational process, some countries suggest using robots with artificial intelligence (Yaponskie roboty, 2018), so the question arises about the possible replacement of teachers with artificial intelligence. However, the results of numerous studies around the world show that the teacher remains an integral part of the educational process. It is the teacher who decides on the feasibility and necessity of introducing these innovations into the educational process (Dam, 2019). The survey was conducted by the authors of this article to study public opinion regarding educational processes using innovative information technologies. As the data of the survey show, the majority of respondents assign the leading role to the teacher (see Figure 2).

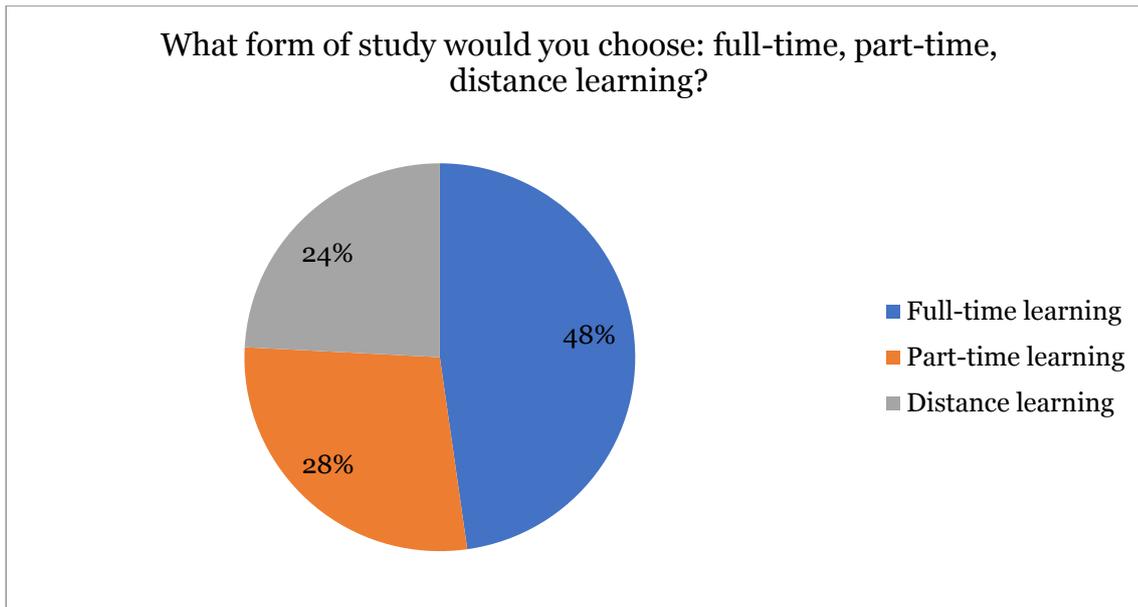


**Fig. 2.** Distribution of respondents' answers to the question: Is it possible to get a high-quality humanitarian education on your own, without communication and consultation with teachers?

The value of the Pearson's chi-square test is 109.029. At a significance level of  $p = 0.01$ , the critical value of  $\chi^2$  is 22. The relationship between factorial and performance characteristics is statistically significant.

In addition, the use of advanced technologies, including AI technologies, is significantly interconnected with other trends in the modern educational process, including the issues of remote education services, since the digitalization of all spheres of public life today can be called the most discussed trend of modern human development, and somewhere even a "fetish" of state policy in almost all developed countries.

The situation with the establishment and use of remote digital technologies in the educational, economic, managerial and professional spheres has been actualized a hundred times during the COVID-19 pandemic, having turned over the past year from a fashion trend into an urgent need, covering those industries that in the "pre-pandemic" world did not embark on the path of digitalization, or began to take only the first steps along this path. In this regard, the attitude towards the application of these technologies in society is of obvious interest. And it is still far from being unambiguous. In our survey almost half of the respondents prefer full-time learning ("face-to-face format") in getting education in the humanities (Figure 3). Also, we note that at the time of the survey the majority of respondents (78.8 %) were receiving (or had already received) a humanitarian education. But even they had some doubts about the effectiveness of distance learning.

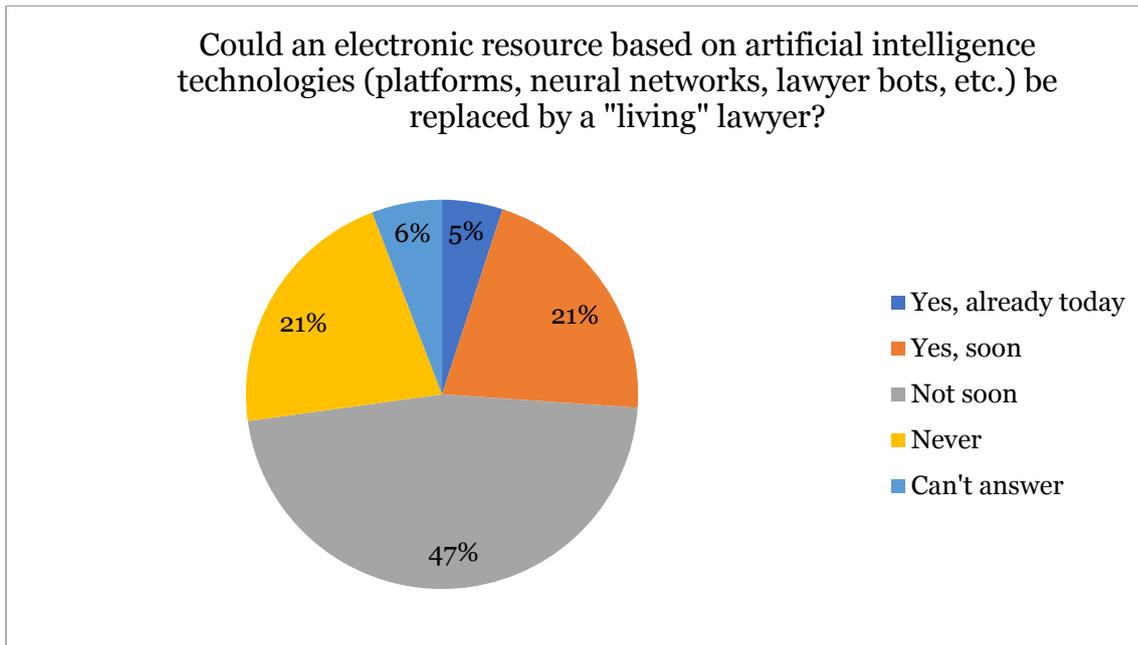


**Fig. 3.** Distribution of respondents' answers to the question: What form of study would you choose: full-time, part-time, distance learning?

The value of the Pearson's chi-square test is 82.751. At a significance level of  $p = 0.01$ , the critical value of  $\chi^2$  is 17. The relationship between factorial and performance characteristics is statistically significant.

As you can see, face-to-face education is given a clear preference, the distance format, on the contrary, was chosen by the smallest number of respondents. This point suggests that with all the obvious advantages of online learning (the comfort of homeschooling (50.8 % of the respondents, if it is possible to choose several answer options), the ease of combining with other types of activity (38.1 %), the function of additional viewing of the material in the recording (55 %), the availability of education from any region (59,2 %), etc.), which were noted by the respondents themselves, face-to-face, live communication with teachers and peers is still difficult to replace in human consciousness (63.9 % of respondents).

It should be noted that in general, the sociological study, some of the results of which we present here, was aimed at clarifying public opinion on the use of distance technologies in legal education and in legal activity. However, in our opinion, another significant point that is worth mentioning in the context of the materials presented in this article: whether an electronic resource based on artificial intelligence technologies (platforms, neural networks, lawyer bots, etc.) can be replaced by a "living" lawyer (Figure 4).



**Fig. 4.** Distribution of respondents' answers to the question: Could an electronic resource based on artificial intelligence technologies (platforms, neural networks, lawyer bots, etc.) be replaced by a "living" lawyer?

The value of the Pearson's chi-square test is 151.172. At a significance level of  $p = 0.01$ , the critical value of  $\chi^2$  is 26. The relationship between factorial and performance characteristics is statistically significant.

The analysis of the answers presented allows us to conclude that one fifth of the respondents do not imagine replacing a person with artificial intelligence, and in fact, almost half of the respondents believe that if it happens, it will not be soon.

## 5. Conclusion

In the course of the study, the authors concluded that, in general, about half of the respondents (48.6 %) consider it impossible to get a high-quality humanitarian education without the participation of a teacher, moreover, approximately the same number of respondents (47.8 %) expressed an opinion about the need for off-line education. Although it is worth noting that a quarter of the respondents consider the format of distance learning with the use of ICT acceptable. It should also be noted that the majority of respondents (68.1 %) do not see any real competition for a teacher, as well as for representatives of other professions from cyber-physical systems based on AI at the current moment or in the foreseeable future.

Summarizing all of the above mentioned facts, we can conclude that when trying to incorporate information technologies, including AI, into our life and into educational technologies in particular, it should be kept in mind that these technologies are just tools designed to improve the quality of the educational process and the interaction of all its participants. At the same time, it is necessary to take into account that these tools are new, not yet sufficiently mastered by both teachers and students, and, therefore, not yet causing the level of trust (4.2 % of respondents) for their effective use, even under the condition that their safety and reliability in use will be precisely confirmed.

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