
EDUCATION IN CIVIL ENGINEERING

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IMPROVING THE UNIVERSITY'S INFORMATION AND EDUCATIONAL ENVIRONMENT IN THE CONTEXT OF THE COUNTRY'S ECONOMY DIGITALIZATION

Abstract. The article analyzes the existing approaches to the definition of the information educational environment (IEE) of the university. It is shown that the variety of IEE interpretations depends on technological, organizational, instrumental foundations. When defining IEE, the psychological and pedagogical approach proposed by V.A. Krutetskiy was used, which is based on information interaction. The principles of creating IEE and its goals, depending on the functions of the information system of the university, are considered. The purpose of the article is, based on the analysis of the most common digital technologies, to determine the directions for improving the information and educational environment of the university through research and development of a new distributed educational resource and services for studying and modeling digital technologies used in a particular branch of the digital economy.

Keywords: the information and educational environment of the university, information interaction, the information system of the university, the principles and goals of the IEE, digitalization of the economy, directions for improving the IEE, digital technologies.

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СОВЕРШЕНСТВОВАНИЕ ИНФОРМАЦИОННО- ОБРАЗОВАТЕЛЬНОЙ СРЕДЫ ВУЗА В УСЛОВИЯХ ЦИФРОВИЗАЦИИ ЭКОНОМИКИ СТРАНЫ

Аннотация. В статье проведен анализ существующих подходов к определению информационно-образовательной среды (ИОС) вуза. Показано, что многообразие толкований ИОС зависит от технологических, организационных, инструментальных оснований. При определении ИОС использован психолого-педагогический подход, предложенный Крутецким В. А., в основе которого лежит информационное взаимодействие. Рассмотрены принципы создания ИОС и ее цели, зависящие от функций информационной системы вуза. Цель статьи – на основе анализа наиболее

распространенных цифровых технологий определить направления совершенствования информационно-образовательной среды вуза за счет исследований и разработок нового распределенного образовательного ресурса и сервисов для изучения и моделирования цифровых технологий, применяемых в той или иной отрасли цифровой экономики.

Ключевые слова: информационно-образовательная среда вуза, информационное взаимодействие, информационная система вуза, принципы и цели ИОС, цифровизация экономики, направления совершенствования ИОС, цифровые технологии.

Introduction

The modern period of development of the information society of mass communication and globalization is characterized by the intensive use of information and communication technologies (ICT) in all spheres of life and activity of a modern person. This circumstance requires graduates of modern universities to have confident knowledge of information and communication technologies in their professional activities.

Currently, there has been a significant breakthrough in the development of information technology, namely, ICT services include telecommunications, web hosting, cloud services and others.

At the same time, the world that has entered the era of the post-industrial digital economy has new, objective features: an inexhaustible source of information becomes the main resource, the Internet provides unlimited retail space, the competitiveness of a company does not depend on its size, the provision of various services can be provided by the same physical resource. the number of times, the operational activity is limited only by the size of the Internet, the business is clearly customer-oriented.

The development of the digital economy in our country entails transformations that inevitably lead to changes in the field of education. Graduates of higher educational institutions must meet new requirements for the quality of education, and universities - the requirements of new priority goals and objectives for the development of modern education.

Therefore, a graduate of a modern university should be ready to work in the

digital economy, and his level of proficiency in ICT tools should ensure his confident use in practice in any area of the economy and industry.

This circumstance determines the relevance of the topic of the article, the purpose of which, based on the analysis of modern ideas about the information and educational environment of the university, to determine the directions of its improvement in order to train specialists in demand on the labor market for the digital economy of Russia.

Literature review

In the context of the informatization of education, issues related to the study and functioning of the educational environment of the university are reflected in scientific research. The analysis of the contents, essence and definitions of the concept of the information and educational environment (IEE), which are currently found in the scientific literature, showed the following.

According to O.A. Ilchenko information and educational environment is a systemically organized set of educational, methodological, information, technological support associated with the student [7].

According to Rakitina E.I. information environment is a set of conditions in which human activity takes place, and the type of this activity determines the nature of the information system (IS): if the activity is educational, then the environment is information and educational [24].

Sokolova O.I. believes that information environment of a university is one of the aspects of its activities, including "organizational and methodological means, a

set of hardware and software for storing, processing, transmitting information, providing prompt access to information and carrying out educational scientific communications" [29].

Belyaev G.Yu. believes that the information and educational environment is a combination of various subsystems (information, technical and educational) of the educational process [3].

From the point of view of A.A. Andreev information and educational environment is a pedagogical system in combination with subsystems that ensure its functioning, namely: financial and economic, material and technical, regulatory, marketing, management [1].

Zaitseva Zh.N. and Soldatkin V.N. believe that the information and educational environment is an anthroposophically relevant information environment, the purpose of which is to reveal the creative potential and talents of both the teaching and the student [6].

Yasvin V.A. believes that the educational environment is a system of influences and conditions for the formation of the student's personality in accordance with the social and spatial-objective environment [30].

Deryabo S.D. believes that the educational environment should be considered as a combination of both positive and negative opportunities for learning and personal development [5].

E.K. Marchenko and others believe that the information and educational environment is a systemically organized set of educational institutions and their governing bodies, data banks, information networks, electronic funds of libraries, etc., as well as a set of means of transferring information data and resources that provide educational activities [14, 15].

So, Yu. Kuliutkin and S. Tarasov believe that the educational socio-cultural environment is formed by a system of key factors that determine the education and development of a person, namely: people influencing educational processes, the socio-political system of the country, natural and socio-cultural environment, including culture

the educational environment, as well as the media and random events [11].

Peskovsky E.A. believes that the educational environment is a part of the sociocultural environment, a system of specially organized pedagogical conditions for the development of a student [21].

In the work "Foundations of Open Education"[2] it is said that the technical structure of the IEE of an educational organization is a system based on the integration of information on traditional and electronic media, operating on the basis of information and communication technologies of interaction, which includes electronic libraries, databases, educational and methodological complexes of various disciplines.

Mukhamatullin R.Yu. defines the information and educational environment as an integrated multicomponent system with maximum variability, capable of ensuring the differentiation of subjects of the educational process, and characterized by the wide use in the educational process of various kinds of information technologies for the formation of knowledge and skills of students by providing access to relevant and operational information, which allows to intensify their cognitive activity [18].

S.V. Korovin in his dissertation research defines the information and educational environment of an educational institution as a complex system, which includes intellectual, cultural, programmatic, organizational and technological resources, the use of which is focused on the implementation of the cognitive activity of students [10].

Kechiev L.N., Putilov G.P. and Tumkovsky S.R. understand by the information and educational environment a set of computer tools and methods of their functioning, which is used to implement learning activities [8, 9].

Methodology

The methodological basis of the article was the fundamental works in the field of theory and methodology of vocational education, theory and practice of informatization of education, the theory of

competence-based approach, as well as the information and educational environment of educational institution.

To solve the problems of the article, the following research methods were used: theoretical analysis and generalization of the provisions of pedagogical science on the problems of professional training of students; study and analysis of the experience of teaching various university disciplines on the basis of ICT tools; analysis of State Educational Standart (SES) and Federal State Educational Standart (FSES) Higher Education, curricula and teaching materials in some areas of student training.

Results and discussion

The analysis showed that the above approaches to the concept of an information and educational environment have different bases and interpretations (technological, organizational, instrumental, etc.). So with a *pedagogical* approach, the definition of IEE is based on a learning model; with the *technological* approach, the IEE is built as a set of information systems; with an *organizational* approach, IEE is built as a tool for managing the educational system or process; with a *methodological* approach, the essence of IEE is determined by the properties under study and the principles of its design.

At the same time, none of the above approaches considers the concept of "environment" on the basis of psychological and pedagogical foundations that were proposed by V.A. Krutetskiy.

A number of researchers (Lapenok M.V. [12], Robert IV [26, 28] and others) consider the information and educational environment in the context of the implementation of the conditions of information interaction.

So, in her research Lapenok M.V. [12] defines the information environment of distance learning (IEDL) as a set of conditions that provide interactive information interaction between the educator, learner (learners) and an electronic educational resource that implements the didactic capabilities of ICT using tools for automating control processes and organizational

management of educational activities based on distance educational technologies.

Robert I.V. under the information and communication environment (ICE) means a set of conditions that ensure the organization of educational activities of a student with an interactive information resource and interact with it as a subject of the educational process [25].

Taking into account the definition of the concept of "environment" in the psychological and pedagogical aspect [20, 22], the definition of the concept of "information and communication environment" [25, 28], as well as, based on the interpretation of this concept in the research Lapenok M.V. [12], Martirosyan L.P. [13], Nass O.V. [19], Robert I.V. [27] and others, as well as regulatory documents of the Ministry of Education and Science of the Russian Federation "by the information and educational environment of the university we will understand the set of purposefully created conditions for the interaction of all categories of users responsible for the development and use of information and methodological support of the educational process based on the information system of the university " [16].

At the same time, under the information and methodological support of the educational process (IMS EP) of the university we mean the set of software and methodological resources for the provision of the educational process and network services for the administration of the educational process.

This definition is based on the fact that the information system of the university is a technical and technological basis, the structure of which includes services that ensure the automation of processes occurring in the university, and the IEE is a superstructure over this basis and provides conditions for the interaction of all its users with the electronic resources available to them. At the same time, the main principles of creating an IEE of a higher educational institution are multicomponent, integrity, distribution, adaptability [29].

The composition of the users categories, depending on the information system (IS) of the university functions, corresponds to the roles that it plays in the training, organizational, administrative and educational processes. The traditional functions of IS include e-learning, administrative and information management, information and reference function and educational function of IS [29].

Depending on the functions performed by the IS of the university, the goals of the IEE of the university should be highlighted: the implementation of information interaction between teachers, students, other users and IMS EP; use of a collective information resource in conditions of remote access; automation of the planning of the educational process, monitoring of learning outcomes, recording of educational achievements; implementation of the educational process during the period of temporary absence of students (illness, work, study on an individual schedule), as well as the implementation of educational, research activities of students studying in full-time, part-time and distance forms.

According to the strategy for the development of the information society in Russia for 2017-2030, approved by the Decree of the President of the Russian Federation dated 09.05.2017 No. 203, the digital economy is understood as "economic activity in which the key production factor is digital data, processing large volumes and using the results of the analysis of which, in comparison with traditional forms of management, can significantly increase the efficiency of various types of production, technologies, equipment, storage, sale, delivery of goods and services" [7].

This means that in the digital economy, a university graduate must not only confidently master ICT tools as a tool for collecting, accumulating, processing, storing, transferring, using, producing information in his professional field, but also know the basics of digital technologies in order to be able to apply these technologies and devices in their professional activities.

The digital economy presupposes a level of development of digital technologies that will allow remote control of the subject environment [31]. Obviously, such control is provided by the corresponding software interfaces, which allow connecting objects of the objective world to the network, as well as the operation of sensors that monitor the functioning of objects in real time.

At the same time, among the existing problems associated with making the digital economy a reality, there is a shortage of specialists who can use highly specialized computer programs and applications in their industry. And on how quickly and competently this issue will be resolved, the success and pace of the formation of the digital economy in Russia largely depends, and one of the tasks of universities should be to form graduates of competencies that would allow them to effectively use software implemented on the basis of digital technologies.

Therefore, the National Program "Digital Economy" indicates the need "... to improve the education system, transform the labor market, create a motivation system for mastering the necessary competencies and the participation of personnel in the development of the digital economy ..." [4].

To further determine the directions for improving the information and educational environment of the university, the definition of digitalization should be clarified: by digitalization of an object or process we mean the transformation of data about an object or process from an analogue to a digital form using digital technologies, followed by automated analysis of digital data and adoption of an optimal, in a certain sense, managerial solutions to improve production or business.

In other words, we can say that digitalization is the introduction of digital technologies in various areas of life to improve its quality and develop the economy. It helps you perform routine tasks and make decisions without human intervention.

The main digital technologies that are currently spreading include: Big Data,

machine learning, artificial intelligence, neural networks, human-machine interfaces, virtual reality, robotization, the Internet of things. The content essence of these technologies is described in [17]. In this article, we will indicate the directions for improving the information and educational environments of universities, where these technologies should be studied, which will consist in the development of information and methodological support of the educational process for the study of digital technologies.

1) Big Data technology should be studied in universities, where the training of applied mathematicians and programmers is carried out, the basic training of which will allow them to create specialized algorithms, software tools and develop special machines.

2) Machine learning digital technology should be studied in depth in economic universities, where they train specialists in the field of trade, marketing, management, banking.

3) Digital technology artificial intelligence should also be studied in economic universities, where they should teach students algorithmic trading based on artificial intelligence, as well as conduct market research and perform data mining, manage financial portfolio and personal finance.

Students attending universities that train engineers for heavy industry should be able to use robots in hazardous work, as well as manage self-learning production process systems and quality monitoring systems.

Future doctors should be proficient in artificial intelligence technology when making medical diagnoses, as well as interpreting medical images using an image recognition system, be able to work with electronic accounting systems, use remote diagnostics and be proficient with new medical equipment such as robotic surgeons, exoskeletons, as well as the creation of more accurate treatment plans for patients using a database of drugs with information about their compatibility and contraindications.

Students studying human resource management systems and recruiting activities, in the face of increased labor mobility and competition for highly qualified human resources, must possess artificial intelligence technology to view candidate resumes, to predict candidate success, to create chat bots for repetitive tasks.

Students of creative universities, in particular conservatories, should study the artificial intelligence technology that underlies virtual composers. Possession of this technology will expand their creative possibilities and allow them to create musical compositions in any genre, and the use of this technology in the educational process will dramatically increase the quality of the educational process.

4) Digital technology of neural networks, based on an algorithm that simulates brain processes based on an artificial neuron model, depends on the application.

In the framework of machine learning, a neural network is implemented in a pattern recognition method, so it should be studied by those graduates who study machine learning technology.

The technology of neural networks used in mathematics allows solving multi-parameter problems, therefore, it should be studied in depth by future mathematicians and programmers.

Students studying in the field of cybernetics should know how neural networks work in order to create models for adaptive control of robotics.

For students studying artificial intelligence, a neural network is a fundamental component in modeling natural intelligence using computational algorithms.

In general, neural network technology is used to create unmanned vehicles, robotics, voice interaction interfaces, analytics systems, and much more.

5) Digital technology human-machine interfaces (HMI) provides a comfortable interaction between the operator and the equipment, enables the operator to control the equipment and monitor its operation, interact

with the process, issue warnings to the operator when an abnormal situation occurs in the operation of technological and production equipment. Since the creation of HMI systems is associated with the concepts of ergonomics and usability (understandable, convenient, comfortable), this technology should be studied by future industrial designers. Mastering this technology will give them a modern tool for designing various production workplaces: chairs, tables, control panels, optimally placed devices, controls (data input devices, displays, workplace lighting, microclimate).

6) Digital technology virtual reality allows you to create an artificial digital three-dimensional world that can be accessed by a person using special sensor devices (glasses, helmet, etc.) through the senses: eyes, ears, vestibular apparatus, etc. Thanks to this technology, it is possible to create ideal conditions for the training of personnel of various specialties. Practicing in the virtual world is an excellent conditions for training personnel for a variety of professions in healthcare and rehabilitation of patients, as well as in architecture, education, light and heavy industry, real estate, sports, film industry, tourism and game industry. Therefore, it is necessary to develop educational and methodological materials in electronic presentation formats for its development in the relevant educational institutions.

7) Digital technology robotization is based on the use of software with artificial intelligence (AI) and machine learning capabilities to handle repetitive tasks of large volume, which previously required people to solve. It should be studied by students who will work in an automated production environment, when human capacities are replaced by robotic systems on an industrial scale.

8) Digital technology of the Internet of Things (IoT) is based on the concept of a computing network of physical objects ("things") equipped with built-in sensors to interact with each other or with the external environment. This technology enables data

collection and control of all assets at a previously unattainable level, as well as connected network solutions, control systems, platforms and applications that take production control to the next level [18].

As noted in his work, Borodin V.A. [4], the Internet of Things is the basis for the next digital revolution, capable of restructuring economic and social processes, while a person will be excluded from part of actions and operations. Therefore, graduates of modern universities, regardless of their specialization, must understand the structure and principles of this technology.

It is especially required to study the technology of the Internet of Things for students of architecture universities in order to improve the infrastructure of the city (control over the timely arrival of transport, the timely removal of waste, the water level in reservoirs and the level of noise and air pollution).

Agricultural students studying the agricultural sector should be able to use IoT technology to record soil conditions (moisture, temperature, plant nutrition). IoT technology is at the heart of precision farming (optimizing operating costs and increasing yields by reducing the use of seeds, agrochemicals, water, fertilizers, as well as more efficient land use), smart farms (automated feeding systems, milking and monitoring animal health), smart greenhouses (automated control over the climate, water supply, pest control), allows you to manage raw materials and agricultural transport (monitoring transport using GLONASS, GPS navigation and sensors, optimization of routes and staff loading), control over the collection, storage and movement of agricultural products (special sensors track the location and weight of the transported raw materials).

Economics students studying logistics should master the technology of tracking the delivery of goods from production to warehouses and retail outlets, as well as from stores to the buyer. Employees of logistics companies must be able to track trucks using sensors that record their condition and emissions into the environment.

Economics students studying commodity science, both food and industrial goods, must be proficient in IoT technology to organize an individual approach to the "connected" customer. Thanks to the IoT, the seller knows certain information about the buyer: what he prefers from the products, what size of clothes and shoes he has, what brands he prefers, which will allow him to timely send information about new products, goods, promotions and special offers. IoT technology will allow real-time analysis of the number of units sold, track the goods in greatest demand, and also automatically adjust the price up or down in order to achieve the maximum sales volume; automate stocks in the warehouse (track purchases, goods arrival at the warehouse, provide control over the surplus of goods that are not in demand, organize the supply system).

Students of construction universities should study the "Smart Home" technology, based on IoT technology, in which control elements receive a signal from sensors and control the operation of devices that perform a task following predetermined algorithms. The system monitors and regulates heating and cooling of the house, burglar and fire alarms, video surveillance and lighting.

In addition, future builders should know and be able to use a new construction control service that combines the use of drones and the process of transferring and analyzing information through cloud technologies. The cloud service allows you to calculate the volume of work performed and compare them with the estimate data, which helps to control the cost of construction.

Medical students need an intensive study of Smart Medicine, in which a network of connected medical devices (personal gadgets, mobile applications, tablets, smart beds and other smart measuring devices) collects data on each patient and transfers them to the hospital information system for further analysis. The use of this technology in medicine will radically change the treatment of patients and will allow you to track their condition, collect information, monitor its

changes in order to automatically warn about potential problems before they become critical.

Students, future specialists of the Russian car industry, should study self-driving cars created on the basis of IoT technology that can assess the situation on the road and correct the route without human intervention. A road university graduate must understand the principle of a "smart car" and understand the operation of an on-board computer.

Conclusion

The article analyzes the term "information and educational environment" of the university. It is shown that the variety of its interpretations depends on various bases and interpretations (technological, organizational, instrumental, etc.). A psychological and pedagogical approach based on purposefully created conditions for the interaction of all categories of users responsible for the development and use of information and methodological support of the educational process based on the information system of the university is proposed. The goals and principles of creating the IEE of the university are considered. The analysis of digital technologies that are currently being implemented in various spheres of the Russian economy made it possible to determine the directions for improving the information and educational environment of the university for training graduates for the digital economy of Russia. This will require research and development of a new distributed educational resource (educational and methodological materials in electronic presentation formats, information and communication subject environments, information and reference systems, knowledge control systems, the implementation of simulation models in subject areas, software and hardware for organizing the educational process, databases of subject areas, etc.) and services for studying and modeling digital technologies used in a particular industry. The information and educational environment of the university, which will provide information interaction with this new distributed

educational resource, will simultaneously provide conditions for the formation of competencies in graduates that would allow them to effectively use software implemented on the basis of digital technologies.

In general, a clear understanding of educational tasks in the field of digitalization is required, related to the need to form the skills of specialists to effectively develop and successfully implement digital transformation projects in any applied field, and this directly depends on the level of training of modern universities graduates.

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