

## THE ROLE AND ESSENTIALITY OF DIGITAL COMPETENCES IN THE EDUCATIONAL PROCESS OF ENGINEERING UNIVERSITIES

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**Abstract:** The urgency of the topic of this article is justified by the impact of the digital economy on the formation of a set of key competencies and education of specialists in demand in the contemporary world. In particular, in the oil and gas industry, where currently all processes are automated, this problem is crucially important. The article discusses the most common approaches to the structure of the competency model of employees in demand in the current community, including behavioral and digital skills, and analyzes the possibility of achieving certain performance indicators in the field of educating competitive personnel for the oil and gas industry. Based on the research results, the article presents relevant proposals and recommendations aimed at improving development of digital competencies in the educational process of engineering universities.

**Key words:** digitalization, digital economy, competencies, digital competencies, digital literacy, oil and gas industry.

### Introduction

Nowadays the youth are often faced with a choice related to the education that should be received and the skills that should be developed at this time. The technological and socio-economic challenges of our time, changes in techniques, machinery and technology, which do not allow formulating an accurate idea of the future workplace, make this choice particularly complicated. Automation of production process is becoming a natural process within the framework of development and represents a necessary solution in connection with increasing competition on a global scale. More simply, we are witnessing the evolution of production, when the control/management functions that were previously performed by people, are delegated to automation. As a result, according to a study by Oxford University, robotization could cause vanishing of 50% of all jobs and professions over the next 25 years (Batova, 2019). In contrast, McKinsey company estimates that one new job in the information technology sector stimulates creation of 2-4 jobs in the economy as a whole.

Taking into account all interrelated factors in the development of economic, social and technological processes will enable us to develop an optimal system of higher education in a single socio-economic complex of the country (Sadykov, 2021). In this regard, in terms of digitalization, it is essential to formulate, maintain and develop employee skills relevant to Industry 4.0. Firstly, it contributes to the achievement of the required level of personnel competitiveness in the labor market, its more efficient adaptation to new conditions. Secondly, possession of such skills will ensure the use of new digital opportunities by employees, which means it will contribute to the growth of the efficiency of personnel and enterprises, as well as development of society and the economy as a whole.

As the President of the Republic of Uzbekistan Shavkat Mirziyoyev repeatedly noted in his speeches, one of the top-target objectives of the consistent socio-economic development of Uzbekistan is the widespread introduction of ICT and digital technologies.

This is precisely the area that represents an effective tool that can ensure high-quality reform of economic sectors and spheres of public life.

Digital transformation is one of the basic trends in the development of modern states, changing the face of almost all spheres of the economy and the social sphere. The COVID-19 pandemic has affected many sectors of the economy, but has contributed to the accelerated development of the IT industry. In addition, it has demonstrated importance of introducing information, communication and digital technologies into the performance of public authorities, private enterprises, and public organizations.

Currently the government of Uzbekistan pays particular attention to strengthening cooperation with foreign countries, in particular, in the area of introducing innovations and advanced technologies. In terms of this issue it is impossible to ignore the role and experience of the countries of the East, which demonstrate impressive GDP growth rates. Such participants in the region as China, India, Vietnam today act as the locomotive of the world economy. Japan and South Korea retain leadership in many areas of innovative and high-tech industries. Singapore, Malaysia and Thailand show exceptional achievements in the export of goods and services to world markets. And the United Arab Emirates, Qatar, Saudi Arabia are making serious progress in the field of alternative energy, innovative projects in the field of finance and space exploration.

#### **Literature review.**

The theoretical and methodological basis of this research paper is represented by the works of domestic and foreign researchers on the formation and measurement of digital competencies, impact of digitalization on vocational education. Peculiarities of the formation and measurement of digital competencies have been considered by Mironova O.A. (Mironova, 2018), Ershova T.V., Ziva S.V. (Yershova, Ziva, 2018), Chulanova O.L. (Chulanova, 2018), Sharipova O.M. (Sharipova, 2019), Gileva T.A., Galimova M.P. (Gileva, Galimova, 2019); Safuanov R.M., Lekhmus M.Yu., Kolganov E.A. (Safuanov, Lekhmus, Kolganov, 2019), Volgina S.V. (Volgina, 2019) in their research papers studied the impact of digitalization on education; articles by Kalimullina O.V., Trotsenko I.V. and Tatarinov K.A. are devoted to the analysis of digital educational tools (Kalimullina, Trotsenko, 2018), (Tatarinov, 2019).

In recent years, alternative means and techniques of teaching have been rapidly becoming wide-spread. More and more preference is given to tools with increased interactivity. As it has been noted by Sharipova O.M., increasing interactivity in the process of work and learning is a factor that enhances motivation and improves efficiency in learning new information (Sharipova, 2019). With the widespread digitalization that has covered most areas and areas of activity, the educational cluster has also been on the focus. Researchers Safuanov R.M., Lekhmus M.Yu., Kolganov E.A. rightly point to the rapid spread of digital technologies, but at the same time they emphasize the lack of experience and the need to create a new methodological system to support educational activities in universities (Safuanov, Lekhmus, Kolganov, 2019).

Within the framework of the problem under consideration, it is worth highlighting three groups of approaches to competencies that are currently in demand. Representatives of the first approach recognize significance of only behavioral competencies. So, the report at the World Economic Forum “The Future of Jobs” in 2016 lists the ten most relevant skills in 2020: solving complex problems, critical thinking, creativity, managing people, interacting with people, emotional intelligence, developing and making decisions, customer focus, negotiation, the ability to learn new things. This model does not directly include digital skills. The consequence of the digital transformation of society is the increasing role of behavioral competencies, since they are more in demand in the information society and least of all amenable to automation and robotization.

To ensure personal competitiveness and demand in the modern world it is necessary to constantly monitor changes in the professional environment, improve knowledge and skills. Therefore, a crucially important aspect of life is lifelong learning (continuous learning throughout life) and the formation of an environment conducive to such development.

The second approach to the in-demand competencies of Industry 4.0 provides for the presence of both behavioral and digital competencies. The appearance of digital skills in the model is associated with ongoing technological changes: digitalization of business processes, possibility of remote interaction, changing forms of employment, etc. As an example, it can be noted that in Russia 77% of households have access to the Global Network, 99% in Korea and Japan, 94% in Germany (Volkova, Konstantinova, Kudaeva, Masalova, 2020). The population uses the Internet for work and personal needs, so skills in data analysis, working with digital devices, creating applications and other digital skills will be necessary to operate in the contemporary environment.

The third approach involves looking at digital skills. In the modern world, not only IT companies are part of the digital economy. Innovative technologies are introduced and applied in entities operating in various industries. And the effective use of digital tools in business operations and digital transformation processes are impossible without improving the digital skills of employees. The concept of digital skills includes competencies that allow people to manage digital processes, implement and confidently use digital tools and knowledge in their work (Tatomirovich, 2021).

In the recommendations of the European Union dated December 18, 2006 on key competencies for lifelong learning, digital competence is one of the eight proposed. According to the developers, it involves the confident and critical use of information society technologies for all spheres of life. Digital competence relies on the basic skills in the field of information and communication technologies (using computers to search, evaluate, present, store and exchange information, communicate via electronic means and the Internet).

**Research methodology.** Based on the goals and objectives of this research article such research methods as observation, comparison, analysis, synthesis, experimental survey and the method of generating ideas have been widely applied.

**Analysis and Discussion.** In order to consistently continue the activities started and the measures being implemented on the development of the field of education and research, the education of our youth as individuals with deep knowledge, high culture and spirituality, formation of a competitive economy, 2020 has been declared the Year of the Development of Science, Education and Digital economy.

In Uzbekistan development of the oil and gas industry is inextricably linked with the introduction of innovations, and at all its stages. Nowadays oil industry is the locomotive of digitalization and introduction of innovations. Modern industrial mining facilities are so complex that it is almost impossible to work here without digital technologies, automatic control, modeling, advanced equipment, modernization and re-equipment. Starting from the use of digital technologies in geophysics and seismic exploration, to drilling oil and gas wells, automation of oil and gas production processes, pipeline management, transport infrastructure, not to mention the accounting of manufactured products, exports, foreign exchange and tax revenues from the industry: all this is impossible to achieve without digitalization, high energy efficiency and capital-labor ratio.

Today the latest digital technologies help companies achieve a high level of efficiency: smart fields, digital twins of refineries are leaders in the implementation of digital innovations, which is the main element of competitiveness in general. And therefore

it is very essential that the students of an engineering university, in particular, the university majoring in oil and gas, study professional software products, which constitute the basis for operating automated workplaces of industry engineers. It should be noted, that the Branch of Russian State University of Oil and Gas (National Research University) named after I.M. Gubkin in Tashkent city is considered the leading university of the Republic of Uzbekistan, which trains highly-qualified personnel for oil and gas industry.

In his Message to the Oliy Majlis, the President of the Republic of Uzbekistan Sh. Mirziyoyev has emphasized that the time has come for an in-depth study of geology: this imposes the Branch with a big responsibility of comprehensive study of geological disciplines. In connection with its implementation the Branch of Russian State University of Oil and Gas (National Research University) named after I.M. Gubkin in Tashkent has launched the Innovation Center for Research. Equipped with more than 30 latest sophisticated computers and workstations, the scientific platform enables to combine investigations of all areas of the oil and gas business, conduct both laboratory and practical classes, as well as applied research. They include carrying out geological and geophysical studies, data interpretation, three-dimensional modeling, hydrodynamic modeling, calculation and justification of risks, analysis and processing of statistical data, large data sets, fulfilling industry orders.

In addition, drilling simulators are widely used to train highly qualified and in-demand specialists in the industry.

Effective training of drilling machine operators is of crucial significance in optimizing productivity, improving safety and minimizing operating costs. Technical errors made in the drilling cycle results in a significant increase in costs at all subsequent stages of production and processing. Based on this, simulators of drilling rigs for operations are widely used in the educational process to provide training, retraining and certification of drilling machine operators in conditions of open pit mining.

The operator of the open pit drilling rig simulator observes the virtual environment on three high-resolution widescreen projection displays located directly around the rig operator's cab, allowing for efficient travel and drilling operations. The cab of the drilling rig is reproduced with high accuracy, all instruments and controls for drilling and movement are correctly located around the driver's workplace.

An example of using the simulator "Drilling rig operator":

- a student (trainee), moving around the location and following the navigator pointer on the right, needs to approach the desired object (the place or object is indicated by a jumping green vertical arrow);

- upon reaching the object, a trainee must press the "use" button, after which the object will be located in the info-space;

- when hovering the cursor over a segment of the object under study, it will be highlighted in yellow and when you click the left mouse button, a panel with information about the segment will appear on the screen;

- the user needs to complete all tasks according to the given conditions, i.e. perform drilling operations advance drilling to avoid damage to equipment.

During the learning cycle of moving and drilling, the rig operator performs all the actions that are performed in real equipment. Models of drilling rigs move and turn realistically, and the exact dynamics of the behavior of the drilling module, interaction with rocks of given characteristics (hardness and drillability) provide a drilling experience that clearly demonstrates the safety and productivity of work.

As the experiment has demonstrated, the performance of students of an oil and gas university, who have used innovative digital learning tools in their learning process, have

been higher than the performance of students who have been trained in the traditional way, without the use of digital technologies (Table 1):

**Table 1**

**Comparative analysis of student performance indicators in the educational process using digital technologies and in the traditional educational process\***

Indicators	Student performance indicators using digital technologies (max 100 points)			Performance indicators of students studying the traditional method at the end of the course (max 100 points)
	<i>Before using digital technologies</i>	<i>Upon completion of the course using digital technologies</i>	<i>Change, in %</i>	
<b>Latest 3D Oil and Gas Field Modeling Software</b>	68	82	+ 14%	76
<b>Drilling Simulator</b>	62	84	+ 22%	71
<b>Use of IT technologies</b>	74	85	+11%	80
<b>Smart panels</b>	71	83	+12%	80

As it is obvious from the results of the experiment, efficient formation of digital skills of students, in addition to developing their general professional competencies that will be necessary in their future professional activities, can make a favorable impact on their overall academic performance.

**Conclusion.** A significant role in the process of developing students' digital competencies and providing the digital educational environment necessary for this in universities is assigned to the teacher (instructor) and his working activity undergoes significant changes. Current teachers should be able to work in an electronic information and educational environment, use various IT tools, use Internet resources to organize the activities of students in the classroom, as well as follow-up activities. As a result, the process of interaction between teachers and students should change significantly, when the former ceases to be a "translator of knowledge", but becomes more of a kind of "tutor" accompanying the individual training of the latter. It is important to remember that the digitalization of education has become a requirement of the time, and the use of digital technologies should contribute to the further improvement of the educational process. Thus, essentiality to develop approaches to the formation and development of digital skills of graduates of oil and gas universities requires reflection, justification, research, building models of digital competencies in the areas of training, designing tools to support and update digital competencies.

\* Developed by the author based on the conducted research.

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