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FORMATION OF KEY DIGITAL ECONOMY COMPETENCIES AMONG GRADUATE STUDENTS OF TECHNICAL UNIVERSITIES

Ekaterina I. Makarenko (a)*, Mariya Yu. Karelina (b)
*Corresponding author

(a) Moscow Automobile and Road Construction State Technical University, 64, Leningradskiy Pr., Moscow, Russia, Makarenko_madi@mail.ru
(b) Moscow Automobile and Road Construction State Technical University, 64, Leningradskiy Pr., Moscow, Russia, karelinamu@mail.ru

Abstract

The article analyses various possibilities for the formation of key competencies of the digital economy in line with the socio-political needs of society. A special role in this process is given to graduate students of technical universities as personnel of higher qualifications, prepared not only for professional, but also scientific activities. The digital economy is understood by the authors as a business activity in which the key factor of production is digital data. The development of a training system for the digital economy is one of the most important areas in line with global trends in the transition to the information society. In order to more successfully and effectively use the personnel base, university graduates must master the key competencies of the digital economy for their use in their work activities. The authors of the article highlighted the Russian specifics of a higher technical school and the training of graduate students: connection with the real sector of the economy, production, industry, in which digitalization is increasingly "gaining momentum": technical capabilities and resources in the implementation of scientific and pedagogical activities, value orientation of graduate students and graduates of technical universities. Taking into account international experience, the authors propose certain measures to increase the effectiveness of the formation of key competencies of the digital economy: working with standards for the training of graduate students in engineering universities; development of information communication, intensification of creative and inventive activity of graduate students.

Keywords: Digital economics, key competencies, postgraduate students, technical education

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1. Introduction

With the transition of the leading countries to the information society, the importance and role of education systems in the training of highly qualified personnel are growing, taking into account the challenges facing national and regional economies. Everything related to the digitalization of the economy today comes to the forefront of technological changes. It is known that education as a whole is the sphere of society where basic social and professional skills are formed; opportunities for personal development are laid. Currently, on a global scale, a request is being formed for highly educated personnel of the new formation: mobile, highly professional, possessing digital competencies and having high competitiveness. The fourth industrial revolution, based on digitalization and informatization, requires more targeted technological training of new personnel, ready to change the organization of production and interaction between social spheres and structures, taking into account a competent approach.

For the Russian economy, which sets ambitious goals to significantly improve the standard of living of the population, ensuring the security of citizens and the state, issues of transition to digitalization become especially relevant. Society expects that the results of the transition to a digital economy will allow us to rise to a new level of production development, and accordingly, will increase its efficiency. However, it must be noted that the leading countries of the world have made significant progress in ensuring the digital environment in general and in educational practices for the development of digital competencies, in particular. Our country is lagging behind in this regard. That is why issues of fuller entry into the digital environment, especially for highly qualified personnel in technical areas, are becoming increasingly important and relevant.

2. Problem Statement

The problematic situation is caused by several contradictions of different levels:

- on a global scale: between the need to transition to a digital economy in line with global trends, on the one hand, and the protection of national interests, the development of digital technologies on domestic equipment – on the other. In addition, there is a deep need for Russia's economic growth based on the development of human capital and renewable non-raw materials;
- at the national level: between the necessary high rate of movement towards digital transformation, on the one hand, and the insufficient opportunities to realize the tasks of the digital economy related to the provision of domestic technological infrastructure, on the other;
- at the level of various spheres of society, and above all, education. This contradiction is reflected in the education system, one of the most important areas responsible for the intellectual development of human capital and the formation of social continuity. The contradiction between the need for the labor market, employment and professions in the personnel of the right qualifications, who own the key competencies of the digital economy – on the one hand, and graduates of higher educational institutions who have not fully mastered these competencies in the training process, on the other, is progressing.

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3. Research Questions

In order to reduce the tension of these contradictions, it is necessary to answer a number of questions related to the implementation in practice of key competencies in the digital economy. Among them:

3.1. What is the need for high-quality training of graduates of technical universities and postgraduate students, as highly qualified personnel, to digital competencies?

3.2. How, without losing domestic historical valuable experience, to prepare highly professional personnel for the digital economy and fit into the requirements of the education system?

3.3. What are the specifics of modern domestic training in engineering universities of the Russian Federation?

3.4. What measures should be taken to raise the level of competence of graduates of technical universities in the digital environment?

4. Purpose of the Study

The aim is to determine the specifics of the formation of key competencies of the digital economy among graduate students of technical universities, as well as to consider social and pedagogical measures that contribute to increasing the absorption of these competencies.

5. Research Methods

The authors used the materials of official statistics, legislative acts when writing this scientific article. Also, when calculating the quantitative ratio of graduate students in technical areas, we turned to methods of mathematical statistics. Value orientations and attitudes as sociocultural factors affecting the labor behavior of graduates of engineering universities in the future were analyzed on the basis of the data of the sociological study "Innovative Activity of the Technical Intelligentsia" (in 2019 – 51 units), conducted by Makarenko E.I., by the expert survey. In addition, the methods of comparative analysis and socio-historical continuity made it possible to consider the experience of training graduate students in engineering universities of our country taking into account social lessons of the past.

6. Findings

We will determine the conceptual scientific field. The digital economy includes economic activity, in which the key factor of production is digital data, the processing of large volumes and the use of analysis results of which, compared to traditional forms of business, make it possible to significantly increase the efficiency of various types of production, technologies, equipment, storage, sale, delivery of goods and services. We note that the digital economy differs from traditional methods of management using digital technologies. In addition, it is aimed primarily at improving the living standards of the population and improving production efficiency.

In 2019, the Russian Federation adopted the National Program "Digital Economy of the Russian Federation", which includes the following federal projects approved by the minutes of the meeting of the

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Presidium of the Government Commission on Digital Development, the Use of Information Technologies to Improve the Quality of Life and Conditions of Entrepreneurial Activity dated May 28, 2019 No. 9.

- Regulation of the digital environment.
- Footage for the digital economy.
- Information Infrastructure.
- Information Security.
- Digital Technologies.
- Digital Public Administration.

One of the projects in the framework of the general program is the project «Personnel for the digital economy», which is directly aimed at the education system in general and at training specialists for the digital economy, in particular. The sphere of higher education is rightly considered as the main branch of personnel reproduction of the economy. Korosteleva (2020) believes that one of the conditions for providing the digital economy with competent personnel is the development of the education system in the interests of training specialists in the field of the digital economy. Transformations in higher education, often used as tools of «shock therapy» to revive the education system itself, are simultaneously projected onto the economy, being a kind of impulse for positive changes (Korosteleva, 2020).

An important indicator of the implementation of the federal project "Personnel for the digital economy" is the fulfilment of the following condition: all graduates of the vocational education system must have the key competencies of the digital economy. Let us list them.

1. Communication and collaboration in the digital environment. Competence implies the ability of a person in a digital environment to use various digital means that allow him to achieve his goals in interaction with other people.

2. Self-development in conditions of uncertainty. Competence implies the ability of a person to set educational goals for himself under emerging life tasks, to select ways of solving and means of development (including using digital means) of other necessary competencies.

3. Creative thinking. Competence implies the ability of a person to generate new ideas to solve the problems of the digital economy, to abstract from standard models: to rebuild the established ways of solving problems, to put forward alternative options for action in order to develop new optimal algorithms.

4. Information and data management. Competence implies the ability of a person to search for the necessary sources of information and data, to perceive, analyse, remember and transmit information using digital means, as well as using algorithms when working with data obtained from various sources in order to effectively use the obtained information to solve problems.

5. Critical thinking in the digital environment. Competence implies the ability of a person to evaluate information, its reliability, to build logical conclusions based on incoming information and data. Let us pay attention to the essence of these competencies. First, they are integral to the digital environment. Second, these competencies are aimed at developing such qualities and skills among students at different levels of education as interaction (communication) with other people, further self-development and self-education of graduates, creative and critical thinking, and the ability to manage information. Third, the competence of the digital economy as a whole is associated with the competence

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of education and training standards specified in educational documents. According to the Law of the Russian Federation, graduate student training in the structure of higher education is currently considered as training personnel of higher qualifications (Law of Education of the Russian Federation, 2014, article 10, chapter 2). In 2019, there were 84,265 graduate students in our country. Graduation amounted to 15453 people in 49 areas of preparation. The authors identified 27 natural and technical areas (without sociohumanitary sciences and medicine). Graduate students in these areas (calculations of the authors based on Rosstat data) amounted to 5760 people, i.e. almost 1/3 of all graduate students. We note that most graduate students receive diplomas in «computer science and computer technology» - 1,164 people, and the least - in «physical and technical sciences» - 6 people, and in such a direction as «weapons and weapons systems» - also 6 people. Graduates of graduate schools in the areas of information technology can rightfully be attributed to the most trained specialists for the formation of a digital environment. *What is the specifics of training personnel of higher qualifications in technical universities?*

1. Higher technical education is most associated with the real sector of the economy, industry and production. It should be noted that industry, according to the concept of development of the digital economy, is one of the priority sectors of its development. In turn, guided by the principle of historicism, it should be noted that at all stages of the development of Russian society there was a direct dependence on the progress of the economy and production, on the results of higher technical schools. Klyucharev (2020) rightly notes that the field of engineering education plays a special importance in the development of the national economy. Ultimately, both production and education are industries that ensure national security (Klyucharev, 2020).

2. In connection with the fourth industrial revolution in the modern world, the speed of changing technical innovations and technologies is intensively increasing. In the preface to the book of the German scientist Schwab (2018) «The Fourth Industrial Revolution», famous Russian financier and politician G. Gref pointed out that «a feature of this revolution... will become the introduction of new technologies will be characterized by great speed....». In the same book, its author proves that the pace of development of this revolution will be exponential and not linear (as it was before). In addition, Schwab (2018) confirms that the fourth industrial revolution is based on the digital revolution and combines various technologies that cause unprecedented paradigm changes in the economy, business, society and each individual. The intellectualization of all public life in global terms is also indicated by the American sociologist Fuller (2018).

It is known that the history of the formation and development of higher technical education shows that this type of education (unlike the sociohumanitary one) requires a more significant material and technical base. The complexity of the modern stage is to provide the engineering school with innovative digital equipment and development, serious technical support. Unfortunately, in our country this issue is far from to be over. Russian society and the education system are only at the beginning of the transition to a digital economy. It is obvious that the pandemic and the related strengthening of digital forms in the economy, remote ways of organizing many aspects of the life of the population have largely "pushed up" the digital transformation, but it is clearly premature to declare its "victorious march". This is stated by Bryzgalina et al. (2021). A key problem for engineering universities, especially regional ones, is the lack

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of scientific research and resources for the creation of laboratories, the implementation of new research projects, and the purchase of equipment.

3. Need to make changes to postgraduate education programs. They require increasing attention on digital environment of their provision taking into account international trends (Petrova et al., 2015).

4.Technical education requires a tougher technological discipline. Of course, the discipline itself among university graduates is encouraged by employers and contributes to self-organization. But a technical discipline as a clear consistent execution of operations, compliance with technology is extremely important for the mastery of digital technologies.

5. We are sure that today's graduate students and graduates of technical universities are the creators of artificial intelligence, the technologies of which are increasingly being incorporated into the digital economy. However, the creation of artificial intellectual systems requires significant social responsibility. For graduate students, due to their characteristics - personnel of higher qualifications - this issue takes on far from idle significance. Modern researchers, Moiseev et al. (2020), consider this problem through the prism of polytechnic education and the influence of social policy on the development of innovative digital products. A number of authors see this situation in the applied aspect, in particular by deeply studying specifically intelligent transport systems (Melnikova et al., 2020).

It should be noted that in the training of the future engineer, not only as a highly trained specialist, but also as an understanding of the social essence of the technical (technological) decisions made by him, domestic and foreign colleagues are mainly in solidarity. In particular, Spanish scientists Castro and Sancristobal (2020) also believe that technical training should necessarily be accompanied by a social understanding of the essence of engineering. In turn, Zandvoort (2010) (Netherlands) explicitly states that technical education is based on principles such as humanitarian and ethical responsibility, since they define the "social face" of an engineer.

5. In this regard, it is necessary to turn to such a feature of domestic engineering education as the training of a representative of the technical intelligentsia, not just a specialist, but a highly educated person with serious worldview positions. This issue has the character of historical continuity since the end of the 19th century, when the domestic technical intelligentsia began to form**.** What are the value orientations of graduates of engineering universities, including graduate students? In 2019, Makarenko (2020) conducted a sociological study "Innovative activity of the technical intelligentsia" using an expert survey. The experts (51 people) were heads of enterprises and organizations engaged in industrial production, as well as representatives of business and the university engineering community. As part of the study, it was proposed to study the problem of value settings and orientations of the modern technical intelligentsia (Makarenko, 2020). According to experts, at present, such an aspect as "constant improvement in one's profession" prevails in the value orientations of the modern technical intelligentsia. This is a positive moment for the development of professionalism and the development of key competencies of the digital economy. After all, it is they who become "at the forefront" with professional improvement. Any highly skilled activity is increasingly associated with the digital environment. We believe that this aspect will continue to dominate if professional excellence is desired. The second place was taken by such a position as "pragmatism, rationalism". Obviously, these qualities firmly occupy a leading role in the value of work. This is due to the increased adaptation of workers to the transition to

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market relations. But it must be understood that such a process involves a departure from such value foundations of activity as "intelligence", "readiness to transfer their knowledge to the young", "patriotism", "high level of culture", which historically in many ways characterized the domestic technical intelligentsia, graduates of engineering universities and, first of all, graduate students. The authors see a resource for the formation of key competencies in graduate students of technical areas in the following.

1. Use of various educational technologies, including distance, e-learning in the implementation of educational programs for graduate students. In this regard, the introduction of new digital technologies into the postgraduate programs of technical universities and the active use of their educational process should be aimed at assimilating the key competencies of the digital economy. The Ministry of Science and Higher Education reported that in Russia they planned to change the standards of higher education. The changes will affect educational programs that are not related to information technology.

2. Support for postgraduate research within the framework of established and new scientific schools. The training of graduate students is, first of all, their inclusion in research work. Modern scientific research in the technical fields is associated with the use of digital technologies; therefore, the development of digital competencies through research activities can contribute to the development of basic and applied science, the formation of innovative technologies. More and more attention is being paid to the development of scientific infrastructure in the regional context, taking into account the needs of local economies.

3. Development of information communication. This was facilitated by the modern pandemic situation associated with the Covid-19 virus. Of course, the forced and rather fast transition to distance learning played a positive role in this situation: new innovative software products and information technologies began to be introduced.

4. Support for the creative potential of highly qualified technical personnel by engaging them in inventive and rationalizing activities. In many ways, this is now going into a digital format. There are many inventor sites. One of the significant and popular ones is the Scientific and Technical Forum "SciTecLibrary" [SciTecLibrary]. Participation and discussions on these electronic sites provide an opportunity to master digital competencies better, learn new developments in science, and determine the time. Moreover, inventive activity is closely related to intellectual property, the problems of which are also actualized in the digital economy. In the most popular block among Internet users "Protection of intellectual property and copyright" we are talking about patenting the results of inventive and scientific activities in technical activities.

7. Conclusion

We are at the initial stage of the transition to a digital economy. Therefore, further study of the practice of forming and implementing key competencies of the digital economy should, in the opinion of the authors, be the subject of close separate analysis and represent a wide field for research by scientists engaged in economics and education and by representatives of other sciences.

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