

Gaps in educational programs in the context of global digitalization

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Abstract — The global digitalization of the economy has led to the transformation of labor market requirements. The European Union, the USA and Russia have responded to these changes by adopting training programs and initiatives with new digital skills. The formal education system demonstrates a lag behind new labor market requirements. The authors conducted a study to identify problem areas in teaching information and communication technologies to university students. The problem areas of educational programs turned out to be programming, working with open software, the principles of ICT functioning.

Keywords — digital economy, education, e-skills, educational programs

I. INTRODUCTION

The formation and development of the digital economy has caused the global digitalization of all spheres of society. For mankind, a situation is no longer new when the transformation of the economic structure entails the need to change the concepts of education. The industrial revolution radically changed the content of education and its coverage of those segments of the population to which it was previously inaccessible. A new paradigm of mass vocational education was formed.

At the turn of the millennium, we entered a new era - the time of the digital economy, when the mutual integration of information technology and the latest trends in the natural sciences, accompanied by a synergistic effect, led not only to the emergence of products with previously unknown consumer properties, but also to profound changes in the whole way of life. In such a situation, the person faced the task of changing himself and the ways of his interaction with the environment, including in the production sphere [6]. New realities give rise to new professions, as well as new requirements for old ones. A shortage of specialists with such skills and competencies that the education system is not yet able to provide in the

required quality and volume has sporadically started to appear on the labor market [8].

Since the beginning of this century, the concept of "digital economy" has been interpreted by various experts in a rather ambiguous manner, sometimes conflicting concepts have been put forward, there was no agreement on the understanding of this phenomenon. The turning point was the signing of "Ministerial Declaration on the Digital Economy: Innovation, Growth and Social Prosperity" by representatives of the leading countries of the world in Mexico in mid-2016 [4].

In 2015, the European Union proposed a comprehensive strategy for a single digital market in order to maximize the social and economic potential of ICT [1]. The strategy consists of three main components: (1) better access for consumers and enterprises to digital goods and services throughout Europe; (2) creating the right conditions and equal conditions for the prosperity of digital networks and innovative services; (3) maximizing the growth potential of the digital economy.

The EU-funded Education Initiative "Digital Opportunity" aims to help companies fill vacancies with candidates with digital knowledge. The program will provide cross-border internships for thousands of students and recent graduates between 2018 and 2020 [7].

The initiative of the US President Barack Obama "Computer Science (CS) for All", announced in 2016 and covering the entire population of the country, is of great interest in this regard [3]. Addressing the nation, the President called for an in-depth study of computer science at all levels of education, including additional. \$ 4 billion was allocated from the budget for the implementation of this initiative, and 50,000 teachers of information technology for secondary and higher education institutions are also being trained at the expense of budget funds.

December 1, 2016 was a landmark date for the development of the digital economy in Russia. In his annual address to the Federal Assembly, Russian President Vladimir V. Putin announced the launch of a large-scale comprehensive program for the development of the digital economy, the implementation of which will be based on high-tech companies and research centers [10]. Thus, the focus is placed on the training of current and future personnel in the necessary skills of using information and communication technologies.

The necessity of changing the paradigm of the entire education system becomes clear: general, professional and additional. The traditional system of formal education, characterized by high inertia, demonstrates a lag behind the new requirements of the labor market [1]. Among the reasons for this lag we can single out a sharp reduction in the time distance between obtaining research results and launching new products and technologies on the market, the synthetic nature of modern research conducted at the intersection of sciences, the progressive increase in the flow of scientific and technical information and new processing technologies, and fierce competition for employees highly qualified. The reserves of the traditional educational system are exhausted, it requires enormous financial resources, and at the same time gives the necessary result only after years. The economy needs to saturate the shortage of qualified personnel today. Partial compensation for the growing crisis was the concept of lifelong education throughout the entire active life cycle of a person, but she is not able to radically solve the problem.

The Organization for Economic Co-operation and Development (OECD) for several years has carried out extensive and in-depth research in various areas of the digital economy, including training. These studies were conducted both in OECD countries and in other countries. The study "Skills for the digital world" [11] revealed a close correlation of the processes of the digital economy, including in the field of personnel training.

In the new conditions, the skills of using information and communication technologies are becoming popular in most jobs. There are three main vectors of this increase in demand:

The first is the most general skills in the field of ICT, for performing routine work on document management, obtaining information on the Internet, and communicating with the external and internal environment of the organization.

The second direction concerns directly the main working tools of labor in the digital economy. Here we are talking about specific professional skills in creating products and services using the entire available combination of new means of labor, i.e., industry-specific software, financial technology, cloud and big data. This area is more relevant for IT professionals with professional programming, database and network management skills.

The widespread adoption of ICT has led to a methodological and technological transformation of work. This causes an increase in demand for complementary ICT

skills necessary to ensure that basic tasks are completed. These include: using social networks to communicate with colleagues and clients, promoting a brand of products on e-commerce platforms, analyzing big data, business planning, etc.

The new economic reality sends more and more signals about the need for a paradigm shift in the training of professional personnel [9]. Studies of the dynamics of demand for basic digital skills have revealed a growing trend in almost the entire world [5]. At the same time, it was revealed that half of the employees who must constantly use office applications have very poor skills in using them.

The tasks set by the program for the development of the digital economy in the Russian Federation by 2024 are impressive in scope [12]. Each year, in the areas of training related to ICT, higher and secondary educational institutions should graduate 800 thousand people, while their level of training must correspond to the global average. About half of the population should master digital skills.

II. METHODS

The aim of our study was to identify problem areas in teaching information and communication technologies to students of higher educational institutions.

We have developed an electronic questionnaire for the survey, in which 250 students of Moscow universities aged 18-24 took part in the spring of 2019. 83% of respondents had work experience.

Three survey tasks were set:

- identifying the ways in which students gained new digital skills;
- identification of areas of digital skills that students lack most;
- self-assessment of the level of digital skills of students.

III. RESULTS AND DISCUSSION

The results of the survey are presented in tables 1 and 2. The university's ranking in the first place, and with a significant margin, indicates that higher education performs its main function at a sufficient level. Eighty-five percent of respondents consider university education to be the dominant area, where they acquire and adopt new digital skills. In second place was self-education, in which the largest place is occupied by online learning. The popularity of various online courses and webinars among young people has grown with the expansion of access to broadband. The third of the most common ways to acquire digital skills is through daily practice at work. A significant role is played by friends and relatives, in contrast to employers who rarely organize in-service training. Courses and trainings are not very popular, most likely due to the transition of this type of activity to a more convenient online mode for students.

TABLE I. DISTRIBUTION OF WAYS TO ACQUIRE DIGITAL SKILLS

Ways to Acquire Digital Skills	%
At university during study	85
Self learning	63
Daily practice at work	51
Friends and acquaintances	32
At home with parents or relatives	22
Help from colleagues	14
Formal training at work	13
Courses and training outside work	5
Other	2

TABLE II. DISTRIBUTION OF ASPECTS NOT SUFFICIENTLY DISCLOSED IN EDUCATIONAL PROGRAMS

Program aspect	%
Programming	41
Work with software on an independent platform	37
The principles of information technology	33
Work with different types of hardware, not only with a personal computer	27
Principles of Electronic Communications Security	25
Using a variety of forms of communication	21
Methods of algorithmic and logical thinking	18
Legal aspects	17
Using apps and services for everyday life	11
Satisfied with everyone	8

In addition to identifying the most common ways to acquire digital skills, the study also revealed some discrepancies between student needs and the content of educational programs. Respondents most often indicated a lack of programming skills, creating websites, and web design. It is these skills that largely determine the competitiveness of a specialist in the labor market, since the demand for them is quite high, regardless of the direction of the employer. In addition, programming itself develops students' logical thinking, the ability to analyze, generalize, and seek new suitable solutions.

37% of respondents said that educational programs do not take into account the multi-platform nature of modern software. Knowledge of open and free software greatly expands the capabilities of a specialist, increasing his value in the market.

A third of students lack understanding of the principles of functioning of information and communication technologies. Given the level of interconnectedness of many information processes, such a knowledge gap can seriously complicate the work of a future specialist.

Most educational programs provide for training related only to the use of a personal computer, as reported by 27% of respondents. Workers have to master another type of equipment, as a rule, at the workplace.

Of particular importance in modern conditions are information security skills that are highly relevant both at the professional and household levels. A quarter of respondents believe that such skills are not provided by their educational programs.

21% of students lack communication skills using information technology. This level of the indicator was rather unexpected, given the extremely high communication activity of young people on the Internet and a variety of mobile messengers. A low need (11%) in the study of applications and services for everyday life indirectly confirms this.

IV. CONCLUSIONS

The digitalization of the economy has brought about changes in staff qualification requirements in recent decades. Projections show that most jobs will require at least a minimum level of digital skills. As part of ongoing government projects and initiatives around the world, priority actions are already being taken to retrain a significant portion of the economically active population for new tasks posed by mass digitalization and automation.

The survey results show that more than half of the students surveyed rated their digital skills as advanced, opening up opportunities for further development. Young people spend a lot of time on the Internet and on social networks, using the resources of the Internet in a variety of situations. They realistically evaluate their skills in creating content, they know how to download online content and make changes to already created content. They are confident in their privacy and data protection skills. In general, their self-esteem is high, which indicates their good knowledge of the digital environment.

However, they realize that they still have a lot to learn in this area. They identified a number of aspects demanded by practice, but not covered by most educational programs.

It is extremely important to raise awareness of the whole society, explaining to him the need to master digital skills. Informatization takes place not only in the commercial and private sector, but also in the public sector, where this process aims to improve the quality of life of the population. Already functioning electronic public services require at least a minimum level of digital skills for a large number of people.

Modernization of education requires an open dialogue between employers and educational institutions. It can have various formats, for example, in the form of regular consultations of educational institutions and employers regarding their requirements in order to adjust the content of their educational programs.

The most significant obstacle to this may be the approach that postulates that a person can and should independently acquire digital skills using modern technologies surrounding him. Practice has proved the failure of this concept. Even in the United States, where such a philosophy is an integral feature of the American business model, it was possible to overcome such views, as evidenced by the successful implementation of the President's initiative regarding universal digital literacy.

The main goal of cooperation between education and business will be the introduction in the curricula and work programs of the relevant competencies demanded by the market.

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