Chapter 24
Preparing Students for Work in the Context of the Digital Integration of the Economy

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24.1 Introduction

The beginning of the twenty-first century is a time of active changes in the economic, political, and social spheres, a time of unprecedented technological inventions and integration processes. The rapid spread of digital technologies, their penetration into all spheres of life, the large-scale changes they entail, and at the same time the uncertainty with the consequences to which they can lead require the attention of professional communities and joint efforts of research scientists from various countries.

All companies whose business concept is primarily based on digital business models such as software or the Internet are considered part of the digital economy. The basis for the active formation of digital changes is a good education in order to acquire additional digital skills, support of network universities, and research institutes.

Digital maturity in organization is related to its ability to use technology for professional and administrative purposes. At the university, this applies to teaching, planning, assessment, communication, resource sharing, student management, reporting, etc. Digital maturity is important for the successful implementation and safe use of digital technologies in the educational process.

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The program "Digital Economy of the Russian Federation" (2019) is aimed at solving problems, including providing the digital economy with competent and competitive personnel (The passport of the national program "Digital Economy of the Russian Federation", 2019).

The formation of such competencies, in our opinion, is most effective within the framework of basic professional educational programs (BPEP), because it is during the development and implementation of educational programs that conditions are created for building an optimal curriculum, taking into account the requests of employers; selection of forms and methods of organizing educational and extracurricular activities; development of methodological support for disciplines and practices, including in the electronic environment of the university; organization of research activities of teachers and students.

The authors consider the substantiation of ways to form competencies of the digital economy within the framework of BPEP as a scientific and practical task.

24.2   Methodology

Perevoschikova, Samerkhanova, and Balaki discuss technological and socio-economic challenges to the education system, approaches to the allocation of competencies and skills of the digital economy and their ranking in their works (Perevoschikova, 2020; Samerkhanova & Balakin, 2020). The interaction of participants in the educational process in a digital educational environment is considered in the works of Samerkhanova, Bahtiyarova, Krupoderova, Krupoderova, and Ponachugin. The authors emphasize that an economy based on digital technologies requires the transformation of production and the social sphere and specialists with new competencies. Some authors believe that a modern specialist should have digital literacy, the ability to master different foreign languages, motivation for lifelong learning, and readiness for labor migration (Samerkhanova et al., 2020c).

There are many approaches to identifying the competencies that are most important for the digital economy. Let's keep the focus on three of them. The following competencies were named at the World Economic Forum in the report "The Future of Jobs": complex problem-solving, critical and creative thinking, human resource management, social communication, emotional intelligence, development and decision-making, customer focus, negotiation, and ability to learn new things.

The proposed model lacks digital skills. All of these skills can be attributed to the group of behavioral competencies, the role of which is increasing in the digital transformation of society, because they are the most difficult to automate and robotize.

The second approach to the competencies demanded by the digital economy implies the presence of both behavioral and digital skills. One of the competency models, which include cognitive, socio-behavioral, and digital skills at the same time, was presented in the report (Russia 2025: From Personnel to Talents, 2017). This report was written by the consulting company BCG.

Digital skills are considered in the third approach. A model for assessing the digital literacy of the population by five indicators was proposed at the G20 summit, which was held in 2017 in Berlin. The NAFI Analytical Center announced the results of measuring the level of digital literacy of the population, presented in the form of an index of digital literacy for Russians in general and for individual social groups, based on this model in 2018. The results of the study showed a high level of digital literacy among 45% of Russians; literacy remains at low level among a quarter of the population.

The developers of the concept of the basic competence model of the digital economy analyzed the competence models of various large companies, on the basis of which the key competencies of the digital economy were determined (Order of the Ministry of Economic Development of the Russian Federation, 2020).

The possibility of forming the competencies of the digital economy within the framework of BPEP has been substantiated. It is shown that the use of the capabilities of the digital educational environment, the use of classroom and extracurricular project activities, starting with the junior undergraduate courses, are necessary to form competencies. The analysis of various digital tools that can be useful in the formation of each of the competencies has been carried out.

24.3 Results

An appropriate digital educational environment should be created for the formation of key competencies of the digital economy at the university. The structure of the digital educational environment of the university, including for the implementation of educational programs, is substantiated in the works (Gruzdeva & Bakhtiyarova, 2014; Gruzdeva, 2019).

The article (Samerkhanova & Imzharova, 2017) presents a model of a unified electronic platform for managing educational programs at the university. We believe that it is possible to track the success of the formation of key competencies using the services "Map of personal and professional development of students" and "Student portfolio".

The article is devoted to the analysis of the capabilities of cloud services for building a digital environment for an educational program. Digital tools for creating content, collecting and processing information, organizing project and research activities of students, their network co-operation and carrying out reflection are presented. Let us consider the possibilities of these tools for the formation of key competencies of the digital economy (Bryksina & Krupoderova, 2016).

Revealing the potential for the implementation of the project method by means of digital technologies will allow to expand its impact on the formation of professional competencies of future specialists (Samerkhanova et al., 2020a).

Information skills are more important than ever before. The need to form the competence "information and data management" in each discipline of the educational program is beyond doubt. The skills of determining the optimal amount of

information, searching for available information channels, finding out how accurate the information is, whether it is possible to interpret it, etc. are necessary when solving any problem. Competent use of digital tools for searching, processing, presenting information in various forms (text, numerical, graphic, multimedia) is required.

The connection between the competence «information and data management» and the information culture of students is obvious. It is necessary to systematically work on the formation of the information culture of students, on teaching the skills of determining high-quality information resources, assessing their reliability, scientific character, and relevance.

At the same time, the digital educational environment of each discipline should be filled with high-quality, methodologically sound content.

Let us give examples of tasks for the formation of the competence "information and data management" within the framework of the "Information technology" module, which is conducted for first-year students of Minin University. Students carry out the classification of information resources according to the form of information presentation in the discipline «World information resources». According to this classification method, all information resources are divided into undocumented and documented. Documented information resources are divided into text, graphic, photo, audio, video, and electronic documents. Students are invited to perform a classification of documented information resources presented in the world digital library https://www.wdl.org/ru.

Students use digital tools such as co-authoring hypertext services, on-line questionnaires, on-line memory cards, infographics, etc. performing tasks for data search, their classification, presentation in different formats. Let us give examples of the use of these tools by future graduates of the "Information Systems and Technologies" program. The development of these information products by students contributes to the formation of the competence "information and data management". Examples of information products are as follows:

– on-line time tape "Information revolutions" (https://clck.ru/Tgeiy), service https://time.graphics;

– on-line interactive whiteboard "Recommendations for Internet Security" (https://clck.ru/Kh2Ub), service https://padlet.com;

– a survey using a Google form to identify the impact of information technology on human life (https://clck.ru/SdCEs) and analysis of survey results using a wiki article (https://clck.ru/SdBub).

Let us consider the competence «critical thinking in the digital environment». Scientists conclude (Paul & Elder, 2006) that people with critical thinking are ready to solve problems, set deliberate goals, inquisitive, ready to correct mistakes, good listeners, make compromises, and tolerant.

The development of critical thinking is at the heart of the mission of the education system. The main tasks of the university are the development of media and information education, contributing to the expansion of the worldview of students, autonomous and critical thinking.

The fundamental attitudes that characterize it and the way of realizing the critical spirit are understood as "critical thinking". The connection between these two aspects is critical in education because practice builds the ability to think critically.

Students come to the university with a certain amount of preconceived ideas, gained from their experience or study of various sources, especially from the Internet. The challenge for the university is to give them the intellectual tools, to challenge these biases and overcome them. Students receive solid theoretical and methodological training, but less often the practice itself, for this.

For example, one of the tasks in the discipline "World Information Resources" is associated with the analysis of sites for the reliability and accuracy of the information provided, while students need to choose the appropriate methods for assessing sites.

Using various visualization techniques such as clusters, fishbone diagrams, SWOT analyzes, cause-and-effect maps, denotational graphs, etc. are useful for developing students' critical thinking. The service https://miro.com was used as an example of the SWOT analysis "Information on the Internet as a global phenomenon" (https://clck.ru/T43Xq).

The "creative thinking" competency is an invaluable skill for students. This is important because it helps to look at problems and situations from a new perspective. Forming this mindset is a way of developing new or unorthodox solutions that do not depend entirely on past or current decisions. This is a way to use strategies for reasoning and ideas beyond the current framework.

Creative (original) thinking is also called lateral thinking, which means using another parallel path instead of the main one, which changes the vision of the situation and allows thinking differently, without the barriers that we usually create ourselves.

The use of the project method is perfect for the development of creative thinking. For example, the project "Towards an Information Society" is carried out in the discipline "Informatics" annually. Students are divided into groups and work together on the university wiki site, answering one or another problematic question. Let us consider some information products from this project: wiki report of a group dealing with the prospects for Russia's entry into the information society (https://clck.ru/Safhx); on-line timeline with the main laws, projects, and programs for the development of the information society in Russia (https://time.graphics/line/440637); on-line presentation "Scientists who developed the concepts of the information society" (https://clck.ru/SdC5z); on-line mental map of opportunities and risks of the formation of an information society in Russia (https://clck.ru/SauZS).

The formation of the "communication and cooperation" competence provides the development of team interaction skills and leadership strategies in various areas of activity to ensure the effectiveness of problem-solving. A variety of digital tools that allow students to interact and collaborate can be used to build competence. Some of them are described in the manual (Samerkhanova et al., 2020b).

Table 24.1 shows examples of students' joint activities in a digital educational environment.

The "self-development in conditions of uncertainty" competence presupposes a person's desire to think and make decisions independently. In our opinion, this competence is inextricably linked with the readiness for lifelong learning throughout

Table 24.1 Examples of joint activities

Example of joint activities of students	Digital instruments
Selection and annotation of Russian Internet services	Google-table https://clck.ru/TCrCT
Collective wiki-encyclopedia of Russian informatics	Article on the university wiki site https://clck.ru/Jg6DQ
Creation of a joint presentation "Our favorite information resources"	Google-presentation https://clck.ru/TCqwD
Collecting guidelines for ethical online behavior	Interactive on-line whiteboard https://clck.ru/SdBub
Collective timeline "History of the Internet"	Service https://www.timetoast.com https://clck.ru/T2jca

Source Compiled by the authors

life. Such readiness should be formed among students within all disciplines of the educational program, in practice, in the framework of research activities.

The modern student has a large number of opportunities for self-development. A person investing in self-development must have a clear vision of the goal and be attentive to emerging opportunities. He must have a strategic life plan and act creatively and innovatively.

Thus, self-development means independently contributing to the intellectual growth acquired through training in various areas of life. This concept is often used in a marketing context, as self-development allows for new entrepreneurial commitments and new job opportunities.

Self-development should be a continuous process and organized in several stages. The subject's action is built on the basis of interaction with the environment in which it takes place, to which he gradually adapts in order to consolidate and improve his position.

The concept of self-development implies a form of belief in the potential of people and in the ability to make changes by improving their sense of existence and their actions.

Purposeful work on the formation of this competence in students contributes to the development of all other competencies, adaptation in further professional activity.

One of them is the possibility of obtaining additional competencies through massive open on-line courses.

Students develop a model of a personal information environment, using on-line tools for building memory maps, in the discipline "Informatics". The model includes software, Internet services, information resources for study, communication, self-development, entertainment, shopping and payments, etc. At the same time, attention should be paid to the licensing of the software. Many students show electronic libraries, massive open online courses, sites for programmers, and sites for various competitions and projects in their models. Teachers draw the attention of students

to the fact that the model will constantly expand during their studies and professional activities. Example of task: https://clck.ru/T8uZh. Service used https://www.mindomo.com.

It is necessary to carry out both educational work and extracurricular activities to form competence in self-development. For example, student programming hackathons are held annually for future bachelors of the "Information Systems and Technologies" program.

For example, the participating teams were asked to develop a project for an automated system to improve the environmental situation of a "smart city" at the hackathon in December 2020. Questions that the participants had to answer in order to successfully solve the problem: what to control to improve environmental safety; what devices and sensors are needed, where and how to install them; where the information received by the automated system will be transferred; and what economic and environmental effects will be achieved through the proposed solution. Teams had to present a project of an automated system using schemes for placing sensors and actuators and a presentation with an algorithm of work.

Another example is the annual round table "The Future of Russian Informatics" in the World cafe format. Students unite 5–6 people to discuss. There is a "host of the table" who writes down the proposed ideas and passes them on to the next group, for each issue discussed. The group discusses the problem at the table for 15 min, after which there is a change of groups at the tables. New members complement the work of the previous group.

World cafe was held in a distance format in the 2020–2021 academic year. Such digital tools as https://zoom.us, https://discord.com, https://miro.com were used for interaction. Zoom is a service for video conferencing online meetings. It played the role of a central channel on which there were presenters, leading the events and commenting on the situation, within the framework of the World cafe. Discord is a video conferencing messenger. The service replaced the "tables", where there was a discussion in groups, within the World cafe. Miro is an on-line interactive whiteboard where participants recorded their suggestions for solving problems. There is no doubt that the World cafe format is a good tool for the development of all the key competencies listed above.

The use of the project method, educational and research activities, starting from the junior bachelor's courses, are also effective for the development of all competencies. The experience of organizing educational and extracurricular project activities of students of the "Information systems and technologies" program is presented in publications.

Let us give other examples of network activities of students in this area of training for the formation of key competencies of the digital economy: various events to celebrate the day of Russian informatics; scientific and practical conferences and round tables on topical problems of the domestic IT sphere, including in a distance format; network projects; and web quests. All students of Minin University maintain electronic portfolios of their achievements, which can be presented to employers in the future.

24.4 Conclusion

The approaches to the formation of key competencies of the digital economy in the framework of the educational program for future bachelors of the "Information Systems and Technologies" program of Minin University are considered.

The didactic possibilities of using various digital tools are considered, and examples of tasks for the development of critical and creative thinking, the ability to work with information, the organization of cooperation of students, their self-development are given. Further formation of key competencies occurs within the framework of professional modules, educational and industrial practices, research activities, extracurricular work.

In addition to the formation of key competencies, it is also important to master modern tools, the so-called end-to-end technologies of the digital economy: blockchain, artificial intelligence, VR and AR technologies, the Internet of things, big data technology, and robotics. It is necessary to create appropriate laboratories, to revise programs of disciplines and practices for these at universities.

Also, the development of options for organizing the interaction of all participants in economic relations from different countries with the help of appropriate digital platforms and tools is on the agenda. And this is the task of both teachers leading IT disciplines and teachers of economic disciplines.

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