USE OF DIGITAL TECHNOLOGY TOOLS FOR FORMING THE READINESS OF FUTURE SPECIALISTS IN ACCORDANCE WITH THE REQUIREMENTS OF THE CURRENT LABOR MARKET OF UKRAINE

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Abstract: The problem of the use of digital technologies by future specialists in the field of higher education in Ukraine was studied. It has been proven that investment in the development of digital skills is a critically important factor in the country's economic growth and competitiveness. The prospects of transformational processes, which allow increasing the efficiency of universities within the framework of the concept of University 4.0, are shown. Among the necessary skills of a modern specialist, we have highlighted: complex problem solving, critical thinking, mobility, creativity, leadership qualities, time management, coordination of actions with others, emotional intelligence, judgment and decision-making, service-orientation, negotiation, cognitive flexibility. To determine the level of formation of the components of future specialists' readiness for the implementation of digital technologies, we used the following components: informational and motivational, cognitive, activity, reflective. The proposed methodology was tested within the framework of an empirical study of the level of readiness of future specialists for the introduction of digital technologies. 84 students of the Faculty of Technological and Professional Education of Glukhiv National Pedagogical University named after Oleksandr Dovzhenko participated in the study: (EG) - 40 students and (CG) - 44 students. The value-motivational criterion of the formation of digital competence of future specialists was evaluated using the method "Diagnostics of values and motives of digital activity", cognitive one was evaluated using "Diagnostics of knowledge, abilities, skills of using augmented reality tools in future professional activities", activity component – with the help of "Diagnostics of the level of technological readiness", reflective – with "Diagnostics of the level of personal and creative readiness of future specialists for professional activity".

Keywords: digital technologies; readiness components; future specialists; labor market; digital competence; training of future specialists.

1 Introduction

In modern conditions, characterized by the formation of the digital space in the global context and the digital economy as a new form of economic activity, there are significant changes in the activities of universities. Industry 4.0 involves the training of professional personnel of a new level, fundamental changes in higher education.

Since the new modes of production involve a continuous process of transmission, accumulation, processing, and analysis of information, "the new person" must be able to cope with these continuous flows. That is why the development of Industry 4.0 is closely related to the introduction of lifelong learning institutions, which involves the constant perception of new information by a person and the continuous improvement of skills. This is also due to the acceleration of technological progress, which constantly makes new demands on a labor market participant. An individual must be adaptive and flexible, have skills in working with digital systems, perform analytical operations and cope with a constant flow of information. Namely these skills and knowledge a graduate needs in order to integrate into a new mode of production. At the same time, the assimilation of these skills and knowledge is in itself a process of accumulating human potential, while the application of skills related to new digital literacy within the Industry 4.0 contributes to unlocking this potential.

The dynamic development of Ukrainian society in modern conditions requires interpersonal interaction of future specialists in all spheres of activity. The modern reality and relevance of the digital transformation of professional activity requires the future specialist to develop digital competence. The ability to interpret and analyze information obtained with the help of digital technologies, which acquires the characteristics of Big Data [1], obtains the greatest significance.

Today, the modern requirement of the labor market is the presence of competent, responsible, competitive specialists who possess critical thinking, show their own initiative in solving professional issues, creativity, social activity and professional mobility, competently and consciously use the means of digital technologies in their professional activities. Currently, digital technologies are a tool that is actively used in education and contributes to the improvement of its quality [26].

The digital transformation of Ukrainian education aims to increase its quality, achieve new educational results, adequate to the requirements of the modern digital society. Today, new requirements occur for all participants of the educational process: from personal and professional qualities, creativity, creative possibilities to knowledge and skills of operating them. In the digital society, human education takes place in the conditions of a digital educational environment, one of the purposes of which is the development of the specialist's digital competence. Today, digital technologies play a significant role in the development and improvement of the quality of modern education.

Prospects for the development of the educational process in institutions of higher education imply the use of digital forms, methods, and tools of learning, which strengthen the effectiveness of the formation and development of digital competencies of the future specialist. Digital technologies occupy a high level in the development and improvement of the quality of modern higher education, the preparation of the digital generation of specialists, as well as the creation of the necessary conditions for their further self-improvement, which is emphasized by the relevance of our research [27].

The process of informatization of modern society significantly affects not only the state of the economy and the standard of living of people, but also the requirements for the quality of education, therefore an important task of building information society in Ukraine is the introduction of digital technologies into the educational process of training specialists.

Changes in the education system that occur under the influence of digitalization are widely discussed in the literature [7, 12]. Much has been written about the benefits of digital technologies used in higher education [12]. Such advantages include: wide access of students to educational information resources; the ability to build individualized educational trajectories; transparency of the activities of educational organizations; optimization of interaction between teachers and students, between all participants in the educational process; formation of mobile structures for managing the educational process, etc.

It should be noted that many world and Ukrainian universities are actively building their "digital infrastructure", which requires significant investment. At the same time, the return on these investments is planned to be high and is expected in the near future. However, as studies show, it is necessary to continue to increase infrastructure investments, including in new educational technologies, while simultaneously raising the priority of investments in the human capital of universities, which, most often, turns out to be "underinvested" [21]. Valuable for the university are its human resources, which should develop in accordance with the ongoing digital transformation.

The development of digital technologies in the field of education is dictated by relevance and is supported at the state level and by the general public. Digitization is a new social situation of "digital divide", "digital citizenship", "digital socialization" [10].

However, the changes in education associated with its digitalization will lead to profound changes in the labor market. The competitiveness of a specialist in the labor market in modern conditions directly depends on his digital competence. Although there a common understanding of the typology of digital skills and digital competencies has not yet been shaped, practice shows a number of clear trends. In particular, the "skills of using digital economy services", which include the ability to use services and processes implemented on the basis of the infrastructure of the Internet of things, are becoming more widespread.

The EU countries have developed a model of digital competencies in five areas [12]:

1) Information literacy (search and extraction of digital data, information and content, data storage, etc.);
2) Communication and cooperation (the ability to interact and communicate, participate in society life using digital technologies, etc.);
3) The ability to create digital content, which implies the ability to develop and edit digital content to improve and integrate information and content into the existing body of knowledge, subject to the requirements of copyrights and licenses, i.e., to know how to write understandable instructions for a computer system;
4) Ensuring the security of devices, content, personal data and data privacy in digital environments, i.e., the ability to protect the physical and psychological health of workers, to be aware of the impact of digital technologies on the environment;
5) Solving emerging problems (using digital tools to introduce innovations in processes and products).

In addition, the so-called talent marketplaces, digital platforms that bring together employers and job seekers in the process of job search and recruiting, enabling and facilitating the creation and development of professional communities, continuous training and career planning, are becoming more widespread.

The concept of digital literacy has gone through several transformations, appearing in the second half of the last century. Initially, it was understood as just a set of technical skills in using computers and other primitive technical systems at that time. However, digital literacy at that time was not considered something necessary - it was an attribute, first of all, of technical specialists who had to directly interact with data and systems. In today's world, there is a completely different 'picture'. Industry 4.0 implies a broad work with data under a significant individualization of employment, an expansion of the range of tasks for each individual, a much greater role for creativity. All this is connected with the processes of technologization, robotization, and digitalization.

The modern concept of digital literacy is defined as follows: "it is the ability of a person to safely use digital technologies to receive, process, store, transmit information, communicate and collaborate, manage digital identity and reputation, create and edit digital content, taking into account knowledge of copyright, ethical standards and responsibilities, organize the security of devices and personal data, manage the privacy settings of information, maintain digital devices, ensure the preservation of physical and psychological health, social well-being, and solve problems of a personal, professional, and public nature" [5]. This digital literacy is today an integral component of the competence not only of technical specialists and representatives of STEM specialties, but of all labor market participants - from educators to managers and marketers.

As can be seen from the definition, modern digital literacy implies a set of a large number of skills and abilities, the formation of which is not an easy task. That is why some authors call it a "pedagogical phenomenon", emphasizing the complexity of the concept, which involves a number of occupations and activities aimed at mastering digital literacy, which involves, first of all, the use of digital technologies to form the readiness of future specialists that meet modern labor market requirements.

At the moment, graduates of higher education institutions in Ukraine are often unable to immediately integrate into the digitalized workflow in the workplace. This is a reason for further reorganization of the educational process in frames of digitalization and introduction of the University 4.0 concept.

2 Materials and Methods

In accordance with modern challenges, the need for transformations in higher education is defined in normative and legal documents of Ukraine, namely: laws "On higher education", "On professional development of employees"; decrees of the President of Ukraine "On measures to improve the higher education system of Ukraine", "On measures to develop the national component of the global Internet information network and ensure wide access to this network in Ukraine", "On measures to ensure the priority development of education in Ukraine", "On The National Strategy for the Development of Higher Education in Ukraine for the period 2022-2032"; in the Concept of the development of digital competences until 2025, the Concept of the development of e-government in Ukraine; provision on electronic educational resources.

Numerous national regulatory documents that have been adopted in Ukraine plan the stages of development of digital society and media, which provide for the reform of the telecommunications infrastructure and the introduction of online services, in particular, the electronic system in the field of health care and e-learning [21].

In 2021, the European Commission introduced the Digital Competence Framework for Citizens (DigComp 2.0), which is one of the basic strategic documents regarding the issue of digital education development [1].

The issue of informatization of education and the features of the formation of the educational information environment by means of digital educational technologies were considered by such Ukrainian scientists as M. Boyko, H. Genseruk, A. Gurzhii, T. Koval, K. Kolos, V. Oliynyk, R. Sharp (features of the formation of the information educational space and the use of information and communication technologies (ICT) in educational activities); V. Bykov, M. Zhaldak, A. Kolomiets, N. Morse, L. Petukhova, S. Semerikova, S. Benet, F. Kirkman (psychological and pedagogical provisions of the theory of informatization of modern education and features of the use of digital technologies in the educational process of a higher school); D. Belshaw, R. Hobbs, P. Murphy, K. Miller, M. Resnik (essence, fluency in digital competence and development of digital culture of future specialists), and others.

The authors of this article in previous studies revealed the theoretical and methodological aspects of using digital educational technologies for training future specialists; a cross-section of the levels of educational achievements of future specialists from the determined value-motivational, cognitive, activity, reflective components and indicators of the formation of digital competence was carried out; the levels of formation of digital competence of future specialists are determined (high, medium, low).

A complex of general scientific theoretical, empirical, and statistical methods was used – in particular, synthesis, conceptualization, experiment, and statistical methods. In frames of the research, processing of the data obtained at the ascertainment and control stages, their comparative analysis were carried out, and verification of the obtained results by methods of mathematical statistics was conducted.

In frames of the empirical study, 84 students of the Faculty of Technological and Professional Education of the Hlukhiv National Pedagogical University named after Oleksandr Dovzhenko took part in the pedagogical experiment: (EG) - 40 students and (CG) -44 students.

3 Results and Discussion

Digital training occupies a prominent place in the professional education of a digital generation student who, in addition to basic digital competencies (preparation of text documents, presentations, tests, etc.), will possess innovative practices for implementing adaptive, blended, distance, cloud, and mobile learning, etc.

The culture of the post-industrial phase is a culture (cultivation) primarily of communication and sociability. The construction of common contexts and the creation of complex forms of organization of activity (meta-machines), the interaction of active persons outside of unified "identities" - all this requires a developed culture of digital communication. At University 3.0, educational and scientific departments of the economic and humanitarian profile come to the fore. In addition to rational justification, the actual design of the activity and its components is required, and, respectively, the following become important subjects: policy and change management; management and innovation management; social design and engineering; digital technical design; design and construction of sign-symbolic systems; foresight and future research. University 3.0, or more precisely, its avant-garde type - an innovative technological university - overcomes the positivist "research of the world as it is", deploying project work and "creating new practices". It opposes "industrial" universities with their inert educational process, which includes standard course packages that quickly become obsolete. The "material body" of the University 3.0 includes, in addition to classrooms, libraries, laboratories, - also business incubators and technology parks, design bureaus, project offices [19]. At the same time, at University 4.0, as its natural evolution "in step" with the evolution of society and the economy, a human, including on a personal level, gets unprecedented opportunities for establishing (mental, design and activity one) of a "new reality" [26]. The positivist paradigm of education is being replaced by the constructivist one. "University 4.0 overcomes the "reproduction of the given" - the given foundations and forms of thinking and activity. It becomes an extremely open environment - a hub for various communications, a node at the intersection of many networks (informational, social, activity). These communications, research and project development involve 'in their orbit' not only professors and students, but also a wide range of external participants. One can say that the fourth generation university is an infrastructural platform for deploying a wide range of search activities (research, design, creation of new practices). For these activities, the university provides various subjects (individual and institutional) with itself as a platform, provides communication and navigation opportunities" [19]. Thus, the university of the future is a University 4.0, a concept that is formed around a digital university and the use of digitalization opportunities as the main tool for a flexible change in communication between the main participants in the educational process, whose result is aimed at solving the challenges of modern industry.

When designing University 4.0, it should be based on the following principles: 1) Speed/flexibility; 2) Transparency and openness; 3) Personal orientation; 4) Productivity. If we consider University 4.0 from the point of view of the interaction of all participants in the educational process, we can single out the main idea that will distinguish such a university from the rest. The use of digital tools (artificial intelligence, data analysis, management based on Big Data) will allow to clearly monitor educational results at all stages of communication between students, and feedback from the customer (business, science, government, etc.) will allow to almost instantly respond and change educational programs (adaptive learning, individual educational programs). This approach makes it possible to solve the problem of training high-quality specialists with the set of competencies that are in demand at the moment, as well as predict the demand on the labor market for the future.

M. Gueve and E. Exposito proposed a scheme of analogy between the different industrial and university revolutions (see Figure 1 below).

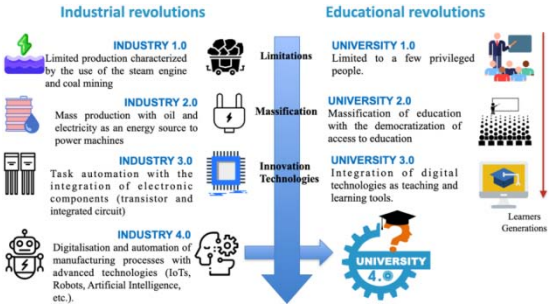

Figure 1. Analogy between the different industrial and university revolutions [9]

The schematic model of University 4.0 itself is demonstrated on the Figure 2 below.

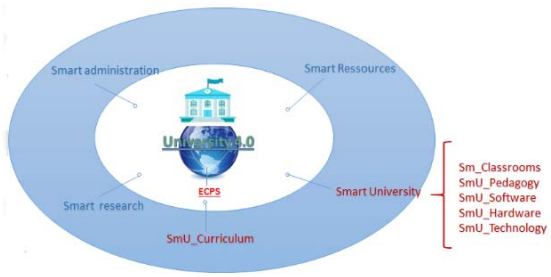

Figure 2. University 4.0 schematic conceptual model [2]

Digital technologies create conditions that differ from traditional ones in the learning process: the ability to study remotely, an increase in the level of educational autonomy and responsibility, the loss of the value of "encyclopedic memorization", the strengthening of the practical component due to the simulation of a professional environment (for example, virtual surgery rooms for medical students), etc. Although recent experiments demonstrate, on the one hand, an excessive cognitive load of students when using virtual reality in the learning process, on the other hand, they demonstrate higher learning outcomes [5]. There is a need for teachers to adequately use not only digital technologies as teaching aids, but also to revise the entire pedagogical paradigm. Thus, we are witnesses of Kuhn' paradigm shift in pedagogical and social science.

We are agree with by N. Morse's reasoning that when designing "digital activity", the teacher focuses on the formation and development in higher education students' skills necessary for a successful career, namely: complex problem solving, critical thinking, creativity, the ability to cooperate, emotional intelligence, skills of negotiation, cognitive flexibility [27].

Based on the analysis of numerous sources on the research problem, it is worth noting that in pedagogy there is no single approach to defining the concept of "digital technologies". We understand this concept as the process of processing and transmitting information using coding symbols applied in computer technologies.

In the context of the transformation of Ukrainian higher education and the requirements of the modern digital society, we single out digital competence as an inseparable component of the professional competence of highly qualified specialists, which we consider as the ability and skill to rationally and systematically apply the latest technologies, educational practices or tools to achieve the set goals. The educational process should focus on the formation of the ability to productively use digital technologies and the development of critical and analytical thinking skills for its intensification,

effective processing of information and its further application in professional activities [14].

Particular importance should be attached to the use of modern digital technologies and tools for the organization of the educational process in the internal network of the Internet. The tool for formulating the context of educational tasks by the teacher is the taxonomy (level classification of verbs) proposed by B. Bloom for the specification of educational goals (results). When designing "digital activity", the teacher, as it was mentioned above in N. Morse's reasoning, focuses on the formation and development of students' skills necessary for a successful career, namely: complex problem solving, critical thinking, creativity, the ability to cooperate, emotional intelligence, negotiation, cognitive flexibility [6; 8].

The use of digital technologies in the educational environment creates opportunities for managing the learning process, methodical support, optimal organization of the joint interaction of the teacher and students, updating forms of interpersonal communication [1].

The advantages of digitization of education include: attracting future specialists to independence; elimination of paper routine; reduction of stationery costs, use of electronic versions of textbooks or notebooks, which requires lower costs; availability of knowledge for people in remote settlements.

At the same time, there are also disadvantages of the digitalization concept: a decrease in the socialization of future specialists; decreasing attention to physical development; reducing the role of teachers [10; 24].

Taking into account the studies of scientists, we offer the following classification of digital technologies that should be used to form the digital competence of future teachers, namely:

- Learning Management Systems (LMS): Moodle, Google Classroom, WebCT, Blackboard, Canvas, and other platforms for online courses support.
- Tools/systems for publishing and sharing/interaction: YouTube, podcasts, eBooks, video lectures, Google Docs, Social Bookmarking, Mind Maps, Wikis, Blogs, etc.
- Social networks: Facebook, Instagram, Twitter, Clubhouse, LinkedIn, Ning, Academia.edu, etc.
- Interpersonal communication tools: e-mail, ZOOM, Viber, Telegram, WhatsApp, Skype, Discord, forums, webinars, Internet projects, etc.
- Mobile applications: software for use on smartphones, tablets, and other mobile devices.
- Content aggregation tools: RSS feeds, NetVibes, Google Reader, and other algorithms to ensure fast and high-quality collection of text data.
- Virtual reality: online games and programs for working in real time, virtual laboratories, etc.
- Evaluation and feedback systems: electronic testing (Google Forms, Moodle), reflection (feedback in audio or written form), electronic notes (Pages, Trello, Evernote), etc.

A distinguished classification of digital technologies will enable future specialists to build the educational process on the basis of productivity, mobility, and autonomy. The outlined digital technologies represent the main complex for the formation of the future specialist' digital competence [21].

At the ascertainment stage of experiment, with the aim of identifying digital tools that allow the teacher to create conditions for an active educational trajectory of students in an electronic educational environment (e-environment), monitoring of the use of online resources was carried out in the following areas:

- Tools for setting educational problems, generalization of the studied material, summarizing (Google Drive, Google Site);
- Tools for checking and consolidating knowledge, forming critical thinking (Learningapps, Educaplay, Flippity);
- Tools for organizing group work, reflection (MindMeister, Cacoo, Bubblus, Mindomo);
- Tools for organizing independent work (Glogster, ThingLink, Google Drive) [16].

In order to check the input state of future specialists' readiness, in ascertaining stage of the experiment, 84 students of the Faculty of Technological and Professional Education of Hlukhiv National Pedagogical University named after Oleksandr Dovzhenko were enrolled as participants: (EG) - 40 students and (CG) - 44 students were involved. Although the University which was chosen for the experiment is of pedagogical specialization, we believe that the results obtained can be considered as conditionally representative for Humanities and Social Science education in Ukraine, while the results of the same experiment for STEM specialties can potentially differ to some extent, due to stronger technical base of such educational institutions and their more close connections with production and business sector.

The check was carried out according to four criteria, namely: the value-motivational criterion of the formation of digital competence of future specialists was evaluated using the method "Diagnostics of values and motives of digital activity", the cognitive one – with "Diagnostics of knowledge, abilities, skills of using augmented reality tools in future professional activity", technological one – with "Diagnostics of the level of technological readiness", reflective – with "Diagnostics of the level of personal and creative readiness of future specialists for professional activity".

The results obtained at the ascertainment stage of experiment are presented in Figure 3.

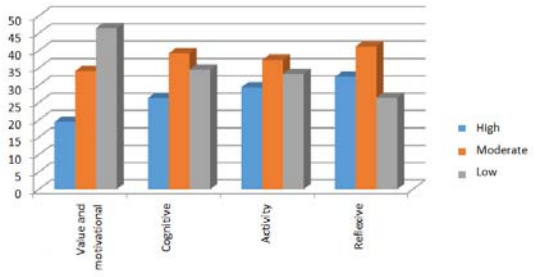

Figure 3. The results of the formation of the readiness of future specialists at the ascertainment stage of the experiment

Based on the obtained data, we can conclude that in the educational process of future specialists, digitalization tools are used mainly at low and medium levels. The main disadvantage of this model is the losing position of the university in relation to industrial partners and the innovation market. Significant distancing from the innovation and labor markets reduces the quality of training specialists in educational institutions. Such a model forms a flawed model of a specialist of the future, who is trained according to outdated educational standards, for existing jobs. This weakens the formation of soft skills, entrepreneurial and lean thinking. Such an approach narrows the funnel of opportunities for the formation of a highly qualified specialist.

Let us describe the digital tools that are proposed to be used during the professional training of future specialists at the Hlukhiv University. We propose to highlight three criteria for the selection of digital technologies in the educational environment of a higher education institution:

- Provision of interactive information action in the learning process;
- Adaptation to the individual characteristics of students;
- The possibility of synchronous or asynchronous interaction of subjects of educational activity [1].

Separated tools include:

1. Google Drive is an online environment where files (pictures, recordings, videos, documents, tables, etc.) are organized, saved, changed, deleted, and added. Files are accessible from any device with an Internet connection, and the changes made are saved automatically. Let us note that this tool can be used in the educational process by a teacher of any discipline (in lectures, laboratory, practical classes). The ability to work through comments allows students to work on assignments synchronously or asynchronously with the teacher, accept or reject the proposed solution, etc. This forces students to study the educational material more consciously.
2. Learningapps is a tool that allows creating interactive exercises. It is a designer tool for the development of various tasks (quizzes, crosswords, puzzles) of different levels of complexity and different subject areas.
3. Cacoo is a tool that allows for collective creation of diagrams and schemes online, simultaneously making changes and discussing work in a special chat.
4. Google Forms – a tool for reflection, creation of the simplest surveys on any topic. It is possible to analyze the results of the survey with the help of spreadsheet tools from Google.
5. Answergarden is a concise tool for organizing instant evaluation of answers, simplifying the process of obtaining statistical data.
6. Mindmeister is a tool for creating mind maps. One can systematize the created maps. New elements (ideas) of the scheme can be highlighted in several ways: font, background color, icon, attaching an explanation to them [1; 3; 11].
7. Google Drive. The advantage is that files are accessible from any device with an Internet connection, and changes are saved automatically. Google Drive includes Google Docs, Sheets, and Slides, an office suite that gives the possibility to collaboratively edit documents, spreadsheets, presentations, drawings, and more. Let us note that this tool can be used in various disciplines (in lectures, practical classes). Students of higher education have the opportunity to process educational material synchronously and asynchronously, analyze it and assimilate it.
8. In the conditions of distance learning, the LearningApps.org service has gained popularity. It is a tool for checking and consolidating knowledge, forming critical thinking. It is easy to use and allows creating interactive tasks of different levels of difficulty: quizzes, crosswords, puzzles, and games. Students can independently create tasks, or they can perform tasks prepared by the teacher. The main advantage of the service is that applications are created exclusively in Ukrainian.
9. MindMeister is a unique tool for organizing group work and reflection. This is a service that allows creating intelligence maps, the use of which in the educational process enables feedback, in particular, through summative and formative assessment. Effective option in the professional training of future teachers is the use of online tools with the help of gadgets. For example, Nearpod is an online tool that allows teachers to create individual assignments and track them using mobile devices. A feature of this service is that users have the opportunity to connect to Nearpod 3D and Nearpod VR.
10. Kahoot is interesting learning game platform that allows creating, playing, opening and sharing fun educational games in minutes.
11. Virtual whiteboards are used to quickly obtain data from students. For example, Padlet is one of the services that allow all participants of the educational process to work together on a web wall, on which one can attach files, photos, links to sites, etc. The wall can be moderated by several participants, while reading and editing access can be open to anyone [27].

In the process of research, it was found that the result of the formation of digital training of future specialists is the formed components of readiness: value-motivational, substantive, activity, and reflective components [17; 23].

Digital technologies allow making the learning process differentiated, building it in accordance with the needs of each individual student, giving tasks that correspond to the level of training and thus improve the quality of education. The use of digital tools contributes to the creation of conditions in which the student becomes an active subject of the educational process. From passive perception, he moves to active actions and is engaged in the performance of tasks.

Indicators of the value-motivational component of the formation of digital competence of future specialists are the motives, purpose, and need for professional training by means of digital technologies; it implies stimulation of the creative expression of a specialist in professional activity, interest in professional activity, the need to improve digital knowledge, interest in working with digital technologies, availability of motivation for digitization in education, and awareness of the purpose of digital activity.

Indicators of the cognitive component of the formation of digital competence of future specialists include: the ability to freely implement digitalization tools in the educational process; availability of knowledge about methods and ways of working with information; knowledge of laws and means of obtaining information, mechanisms of development of means of digital technologies. The level of development of the content component is determined by the completeness, depth, and systematicity of the future teacher's knowledge.

Indicators of the activity component include the ability to practically implement digital technologies; ability to self-improvement and creativity.

Indicators of the reflective component of the formation of digital competence of future specialists are self-awareness, self-control, self-evaluation, understanding of own importance in the team and understanding of the results of own activity, responsibility for the results of own activity, self-knowledge and self-realization in professional activity; it also implies the ability to use acquired knowledge and skills in new and non-standard situations, perform reflective analysis and correction of digital activity.

The pedagogical experiment was implemented at defined stages of the developed technology: value-motivational (assessment was based on the motivational component), content-activity (assessment was based on the cognitive and activity component) and reflective-corrective (assessment was based on the reflective component). The developed technology had the following features of implementation in the educational process: a goal was set for the student and a reward for its achievement was determined; the volume of tasks increased gradually; students received favorable reviews; the competition was a mandatory element in the process of forming the digital competence of future specialists by means of digital technologies.

Thus, the developed methodology contributes to: the organization of an active digital educational environment, the provision of various forms of integrated learning, the monitoring of student development, the improvement of the competence training methodology, in particular, the formation of digital competence of future specialists.

The results of the data obtained at the formative stage of experiment are presented in Figure 4.

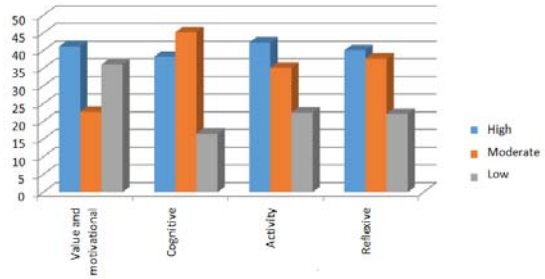

Figure 4. The results of the formation of the readiness of future specialists at the formative stage of experiment

The experimental implementation of the developed methodology indicates positive results of the formation of digital competence of future specialists by means of digital technologies. The use of digital technologies in education had a positive value in determining the final result.

For support and a kind of triangulation of our obtained results, we compared them with the empirical study conducted by Jugembayeva, Murzagaliyeva, and Revalde on the base of Al-Farabi Kazakh National University from April to May 2021 (published in Sustainability journal in 2022). The study for comparison was chosen due to significant similarity of higher educational trends observed on post-soviet space since 1990s, as well as high degree of material and technical base similarity.

After development and implementation of a learning program grounded on the University 4.0 principles, the authors obtained the following result (see Figure 5 and 6 below) [13].

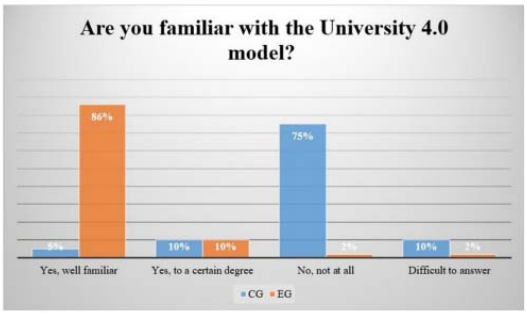

Figure 5. Respondents' answers to the question "Are you familiar with the University 4.0 model?" in the experimental study by Jugembayeva et al. (2021) [13]

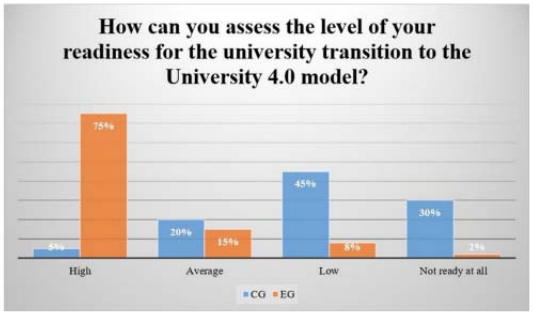

Figure 6. Respondents' answers to the question "How can you assess the level of your readiness for the university transition to the University 4.0 model?" in the experimental study by Jugembayeva et al. (2021) [13]

As evident from the figure, digital tools greatly facilitate students' awareness of digital transformation and readiness for learning and working in digital landscape.

On the basis of the conducted research, several classifications of the levels of readiness of future teachers for the introduction of digital technologies have been identified, namely:

- Adaptive;
- Elementary;
- Partially search;
- Creative and active.

The adaptive level is characteristic of teachers who have a low level of knowledge in general and special disciplines; level is characterized by a lack of independence in educational activities, insignificant training in the field of informatics and information technologies, a weak level of control, self-control and correction of own professional activity, a manifestation of dissatisfaction with the choice of profession, a weak level of awareness of the goals of the formation of professional activity.

The elementary level is characterized by a passive and episodic attitude to professional activity, fragmented and unsystematic knowledge of general and special disciplines, insufficiently formed skills to use existing knowledge for the formation of professional development as a teacher, partial mastery of the basic material on informatics and information technologies, the presence of a need for self-improvement only in the event of difficulties in professional activity, difficulties in the process of planning, control, and self-correction of own professional activity.

The partially search level is characterized mainly by an emotionally positive attitude to professional activity, high-quality knowledge of general and special disciplines, activity in their further mastery, a sufficient level of mastery of informative material, the ability to analyze, systematize, forecast in the field of digital technologies, the ability to evaluate and correct own professional activity, the ability for self-development and self-diagnosis, but not always adequate self-assessment of own capabilities.

The creative and active level is characterized by a clear positive attitude to professional activity, a high level of mastery of informative material and the use of digital technologies in professional education, the ability to systematize, separate, and present material to students with high quality, creatively apply tasks to familiarize future specialists with digital technologies, the ability to find solutions in non-standard situations, a high level of knowledge, the comprehended need for professional self-improvement and personal development, deepening of theoretical and methodical knowledge, adequate self-esteem and a high level of independence.

Achieving a certain level of readiness involves the formation of influence on the individual, the creation of conditions that correspond to his characteristics, while the concept of formation will be considered as the creation of favorable conditions in which the individual will be able to freely choose the content and possible means of further development [3; 9; 12].

Therefore, in order to increase the level of future specialists' readiness for the implementation of digital technologies, it is necessary to define pedagogical conditions for readiness formation:

1) Orientation of the basic professional training of the future specialist on the formation of striving, special and methodical readiness of the future specialist to use digital technologies in his further activities;
2) Designing and constructing the content of the information education of the future specialist from the elements of the content of his basic training and specially developed training courses, the sequence of study of which is determined according to the stages of development of his focus and training;
3) Step-by-step management of the process of forming the readiness of future specialists to familiarize themselves with digital technologies as part of the integral process of their basic professional training [10; 13].

Concluding the examination of the problems of digitalization of education, it should be emphasized that it cannot be qualified unambiguously as a process that by itself will solve all the pressing issues of training future specialists. We believe that in the not-too-distant future, artificial intelligence, digital and robotic systems will liberate humanity from routine, algorithmic and reproductive activities, people who are able to think creatively and critically, tirelessly study and research, and make responsible decisions in situations of increased uncertainty and risks, work creatively and productively in teams of specialists will be in demand. Namely this perspective should direct both the scientific and pedagogical community to new searches in the field of digitization of education.

4 Conclusion

It should be noted that the implementation of digital technologies is very important for the development of the system of higher and professional education, but along with this, it is necessary to form a scientifically based approach to their introduction. A promising education system should be able not only to 'arm' the future specialist with knowledge, but also, due to the constant and rapid updating of knowledge in our era, to form the need for continuous independent mastery of knowledge, abilities, and skills of self-education, as well as independent and creative activities throughout the entire active life of a person. This necessitates the development of digital didactics, or digital pedagogy, which would not only reflect the essence of the ongoing changes, but would also solve applied tasks related to the digital learning process, including psychological aspects. For example, researchers propose the principle of the "generational convention", which implies the rejection of the "presumption of incompetence" of the younger generation, that gives rise to excessive guardianship, reaching the verge of authoritarianism, and does not contribute to the development of such qualities in the younger generation as independence, responsibility, initiative, creativity. The digital format of education should not be aimed at erecting barriers between participants, but at establishing connections between people, helping students not only learn themselves, but also teach each other. The digital format of education is not only an external form, but also a conceptual framework that involves restructuring the concept of higher education within the Industry 4.0, since the digital university itself is the first step in the formation of a 4.0 model university, and along the way solves the problem of developing digital competencies in the process of using digital technologies. In order to prepare students for the future, the content of education should be perspective-oriented, focused on what is still little explored or only manifesting itself, rather than focusing on what is already known and familiar. This does not imply a complete rejection of the known, traditional, but only speaks of the need to shift emphasis, study the new in connection with the existing, and not study the existing without taking into account the future.

Ukraine needs highly professional personnel, so the task of domestic science is not only to borrow the best foreign practices, but also to develop a scientifically based anticipatory educational strategy based on the best domestic scientific schools and advanced digital technologies. The information and educational environment provides unique opportunities for students to acquire knowledge both independently and under the guidance of teachers, which is a rather promising direction for further research.

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