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THE DEVELOPMENT OF DIGITAL COMPETENCIES AMONG TEACHERS IN THE CONTEXT OF TRANSITION TO THE «UNIVERSITY 4.0»

Abstract

The article is devoted to describing the digital skills required of pedagogical employees to function in the contemporary educational environment. Also, the article discusses potential methods for developing prospective teachers' digital capabilities in a university setting through the creation of contemporary, pertinent, and in-depth content as well as instructional, methodological, and informational assistance.

The most popular methods for structuring the competency model of job candidates for Industry 4.0, including behavioral and digital skills, are covered in the article. On the basis of an analysis of the likelihood of achieving particular performance indicators in the sphere of vocational education, the limitations in the growth of graduates' digital capabilities were demonstrated. Different interpretations of the traits of digital competences in Kazakhstan and other countries are offered to create a cohesive approach. The degree of digital literacy of contemporary future teachers was evaluated to examine the viability of developing a digital learning environment at universities.

The influence of the digital economy on the development of a set of key abilities and the education of experts in demand in contemporary society is what gives this piece its relevance. The majority of models and frameworks are concerned with evaluating university teachers' level of digital competences, which are a collection of knowledge, abilities, and attitudes required for a teacher to use technology effectively. The impact of the digital economy on the development of a set of core competences and the education of experts in demand in the contemporary world.

Keywords: digital competencies, successful pedagogical activity, modern educational space, ICT competencies.

Introduction. Nearly every nation in the globe is currently impacted by the digitalization process. Each nation sets its own priorities for digital development at the same time. National digitization plans are now being implemented in more than 15 different nations. China, Singapore, New Zealand, South Korea, and Denmark are the top nations in the world when it comes to

digitalizing their economies. China is integrating digital and traditional industries through its Internet Plus program, Canada is building an ICThub in Toronto, Singapore is developing an ICT-driven Smart Economy, South Korea is concentrating on human capital development, entrepreneurship, and the sharing of accomplishments through its Creative Economy program, and Denmark is concentrating on the digitalization of the public sector.

Digital competence and literacy are not defined in the current legislative framework, the Law «On Education» (Law of the Republic of Kazakhstan dated July 27, 2007 No. 319-III). Information and communication technologies, which are regarded as higher education in ICT, are included in the SCES of higher and postgraduate education.

According to the Concept of Modernization of Pedagogical Education of the Republic of Kazakhstan, at the moment, purposeful work is underway to digitalize educational organizations: relevant disciplines have been introduced into educational programs in the field of Pedagogical Sciences, qualification requirements for university teachers have been adjusted, intense work begun for university teachers and future school teachers to develop new specific digital competencies.

As part of the National Program «Digital Kazakhstan» from 2017, many events were held to develop the digital competencies of teachers. For example, digital platforms have been created, such as E-School, which allow educators to create and use electronic textbooks, conduct online lessons, and organize interaction with students and parents.

Also, programs for advanced training of teachers in the field of digital technologies were developed. For example, within the framework of the Digital Competences of Educators program, teachers are allowed to be trained in the basics of using digital technologies in the educational process.

Literature review. There are clear trends in the advancement of higher education in the current environment, including a shift in the status of universities due to increased risks and experimentation in scientific activities, the shift from competition to partnerships, access to large databases (Big Data), the transition to open educational resources of various formats (Open Online Resources), a combination of new and traditional formats of training, and the renovation of classrooms in traditional and new ways. Technologies like learning on mobile devices (Bring Your Own Devices), the switch to «flipped classes» (Flipped Classroom), the development of «designer spaces» (Makerspaces) – high-tech platforms using 3-D printers, the development of «wearable» technologies like Google Glass, the growth of adaptive learning through the introduction of digital platforms, and the use of artificial intelligence (AI) in learning are just a few examples.

University 4.0 is a new generation of universities that use hi-tech to provide an education that meets today's challenges. The development of digital competencies in future teachers plays a key role in the creation and support of such universities (Oddone 2023).

The development of digital competencies among teachers in the context of the transition to the «University 4.0» model is of high scientific importance. This is due to the need to adapt educational institutions to new requirements caused by the rapid development of digital technologies and the changing needs of students and the labor market (Basilotta-Gómez-Pablos et al., 2022).

The importance of developing the digital competencies of teachers in the context of the transition to the "University 4.0" model lies in the fact that they will be able to successfully integrate digital technologies into the educational process, create new electronic learning materials, and use online platforms for conducting classes and communicating with students. This will create a flexible educational environment that can respond to the needs of modern society and the labor market (Roll & Ifenthaler 2021; Auer & Rüütmann 2021).

Additionally, the improvement of educational quality, an uptick in student motivation, and an increase in the effectiveness of the teaching process can all result from teachers developing their digital competences (Tomczyk & Fedeli 2022). According to research on individual innovativeness in nurses by Danac et al. (2023), educators with digital skills can better adapt to

changes in the educational environment, establish innovative teaching techniques, and take part in the development of new digital technologies for education.

The active development of the virtual educational space in recent decades has become a natural response of the higher education system to the challenges of the information society. The modernization of the educational process undertaken in this regard has actualized the problems of organizational, managerial, resource, normative, educational, methodological, and program updating of educational programs of universities. A necessary condition and an indispensable element of this modernization, the successful introduction of digital innovations in the educational process is the readiness of the teaching staff to work with electronic educational resources, digital content, and platforms for organizing distance learning (Fursykova et al., 2022). The lack of such readiness reduces the quality of the educational process, leads to the professional isolation of teachers, and narrows the educational opportunities of students. It cannot be unequivocally stated that this problem manifested itself only in an unfavorable epidemiological period and became a serious obstacle to the organization of distance learning, It existed before but was more latent, and did not have such large-scale negative consequences for the quality of education. In this regard, we have attempted to analyze the problem of the teacher's readiness to organize digital learning and offer a vision of its solution.

In recent years, in pedagogical science, the issue of building a model of teachers' digital competencies has been actively discussed, since the degree of their formation will determine the effectiveness of the digital educational process. Based on the analysis of various models of digital competencies presented by expert and scientific communities, Antonova et al., (2018), substantiate the possibility of applying these models to the digital competencies of a teacher. The authors conclude that the teacher should be required to express pedagogical competencies, including the processes of using digital resources, as well as organizing training, assessing, and empowering students when using these resources. At the same time,

the digital competencies given by the authors (working with information, searching for it, critical perception, checking for reliability, using social networks, producing multimedia content, and security), ensure the digital literacy of any representative of the information society, is the most important basic requirements for the work of a teacher in digital education. Basic digital literacy is a necessary condition for professional development in the field of introducing digital technologies into the educational process.

Main part. The concept of digital literacy was first introduced in 1997 by Paul Gilster, an American writer and journalist. According to Gilster (1997), constantly being on the Internet, in the field of hypertext, which makes it possible to quickly navigate from one resource to another, forms new patterns of human behavior, information search techniques, and communication features. This leads to the formation of network thinking, the main feature of which is a high degree of information and communication activity. Digital competence emphasizes socio-communicative aspects of human activity. Gilster (1997) identifies the following skills as criteria for achieving digital competence:

1. skills to search for the necessary information and tools for working with it, the ability to quickly master these tools (information competence);

2. communication skills with other users (communicative competence);

3. skills in the production of information in its various forms and formats (creative competence).

Tejada et al., (2018) believe that digital competence has gained a lot of importance in the educational context in the last decade. There are several reasons, on the one hand, the use of technology has become a daily occurrence; on the other hand, the professional development of many citizens largely (and increasingly) depends on the efficient and effective use of ICTs. Cabero et al., (2020) point out that digital competence is one of the key competencies that citizens in general and educators in particular must master in the society of the future.

Digital competence is one of the eight core skills for a complete life and active citizenship, according to the Framework for the Renewal of Core Competences for Lifelong Learning

(2018/C 189/01), which was accepted by the European Parliament and the Council of the EU in 2018. Digital competence is the ability to critically and confidently use information society technology for communication, learning, job, and enjoyment.

According to DigCompEdu, educators need the following digital resource competencies:

− Selection of digital resources;

− Creation and modification of digital resources;

− Digital resource management, protection, and sharing (Redecker, 2017).

Digital competencies are the confident use of ICT in work, leisure, and communication. Indeed, in the information society, the ability to search, analyze, and use information is one of the most important qualities of a person. Competence development indicators can be divided into five areas: information retrieval, communication, content creation, network security, and problem-solving (Table 1).

Table 1. *Comparison of digital competencies of a teacher and a student*

Teacher	Student
Knows the principles of preparing students for life in a digital society.	Knows and uses educational programs, applications, and games in their studies.
Knows the latest educational trends in the IT field.	Creates texts, graphics, and multimedia presentations.
Knows gamified software educational support, taking into account the interests of students.	Uses social media to communicate with fellow students.
Constantly uses new IT technologies to improve the quality of education (for example, web quest, video games, augmented reality).	Looks for relevant information on the web, including invisible to search engines.
Adapts the capabilities of computer programs to present their ideas to students.	Able to work remotely in a team.
Shows students the ways and techniques of using digital technologies to consolidate their knowledge and solve educational problems.	Able to creatively use innovative IT technologies.
Uses ICT ethically, respecting copyrights.	Aware of the ethical and legal aspects of working on the web.
Respect the confidentiality of the information and take care of its image on the web.	Critically and reflectively evaluates web content.
Collaborates with colleagues using IT tools.	Use interactive media safely for yourself and others.
Critically evaluates information from the web network in terms of its reliability.	Able to use remote services offered on the Internet.

In areas including curriculum planning and design, learning resources, classroom management, giving feedback, and performing pedagogical exams, among others, Perifanou et al.'s research reveals that more than half of educators have never used digital tools (Perifanou et al., 2021). Technology integration into classroom instruction is challenging when educators don't embrace it well (Legris et al., 2003; Bai et al., 2020), which prevents technology from structurally altering learning (Lei, 2018; Tondeur et al., 2019).

Willis et al., (2019) note that students should prepare for this digital world by acquiring relevant competencies. Furthermore, Martin et al., (2020) in their research recorded that students are prepared for an integration of online studies in education. According to Mußmann et al., (2021), this is a significant responsibility for teachers to mediate and promote student competencies. Consequently, the requirements for teachers have not only changed but also increased.

This view is shared by Harrell & Bynum (2018), who believe that educators have a responsibility to integrate technology into the teaching and learning process to prepare students with the necessary skills for career advancement in the 21st century. Preparing digitally literate learners requires educators to use appropriate digital tools and systems in educational environments (Falloon, 2020). According to Janssen et al., (2013), digital competence includes more than

knowing how to use technological devices and applications. Therefore, educators should have a set of necessary technological competencies that will be useful when introducing technology into classroom practice.

In the works of researchers Yachina & Fernandes (2018) there are three main digital competencies related to learning activities:

1. the ability of the teacher to focus on digital means of creating and using educational resources;

2. The teacher must be able to distinguish between the main digital educational resources and use them in the classroom in an educational institution;

3. the ability to design training sessions using digital educational technologies (Yachina & Fernandes 2018; Dukhovnikova & Korol 2021).

Zhumasheva (2021) considers the digital literacy of a teacher as a system of basic knowledge, skills, and attitudes in the everyday use of digital technologies. According to Akhmetova et al., (2023), it is very important to solve the problem of digital literacy of modern teachers of higher educational institutions; this will help to understand the readiness of teachers to digitalize education in general and determine their role in the educational space using distance technologies.

Purpose of study. It is the educator's responsibility with information competence to indicate to students which sources are authentic and regularly updated, or if there are other useful sites related to the discipline, and more importantly, if the information is written in biased language or objective. It is the teacher who inspires students to creativity fast deep thinking and logical analysis. This way, students come out with original ideas and their answers. The teacher should encourage them to have a comprehensive knowledge of the relevant software.

In this regard, we consider it important to study the level of ICT literacy of teachers of Kazakhstani universities, which includes, by analogy with the European model of digital competencies for education, six modules. The study aims to measure the level of ICT literacy of teachers of the Abai Kazakh National Pedagogical University and the University of Turan-Astana.

Materials and methods. The teacher, whose employment is undergoing considerable changes, is given a significant role in the process of developing students' digital competencies and providing the digital educational environment required for this in universities. Modern educators should be able to operate in an electronic information and learning environment, use a variety of IR technologies, arrange students' work both inside and outside of the classroom using online resources, etc. As a result, when professors stop acting as "translators of knowledge" and start supporting students' individualized training, the way they interact with one another should change substantially. Regarding this, the readiness and level of growth of digital competencies are issues.

Participants. For this article, we conducted a study to measure the level of ICT literacy of university teachers (Redecker, 2017), namely the Abai Kazakh National Pedagogical University and the University of Turan-Astana.

Data collection tool. The data collection instrument was the European model of digital competencies for education's six modules.

Data analysis. Data was analysed using statistical methods. Descriptive statistics were taken, and a chart was used to present the results.

Results. The results from the European model of digital competencies for education's six modules per the responses of our participants are summarised below.

1. The professional duties of teachers in the context of the adoption of digital technologies are expressed not only in their willingness to use them in the educational process, but also in the demonstration of skills like the desire for ongoing development in the digital environment and their willingness to collaborate in the workplace. Only 75% of respondents used digital tools routinely for communication with coworkers and students, and only 45% used them to share professional development or work together on materials with other teachers. 20% of those surveyed talk about potential uses of digital technology in education with coworkers and, if necessary, assist in the creation of suitable techniques (Figure 1).
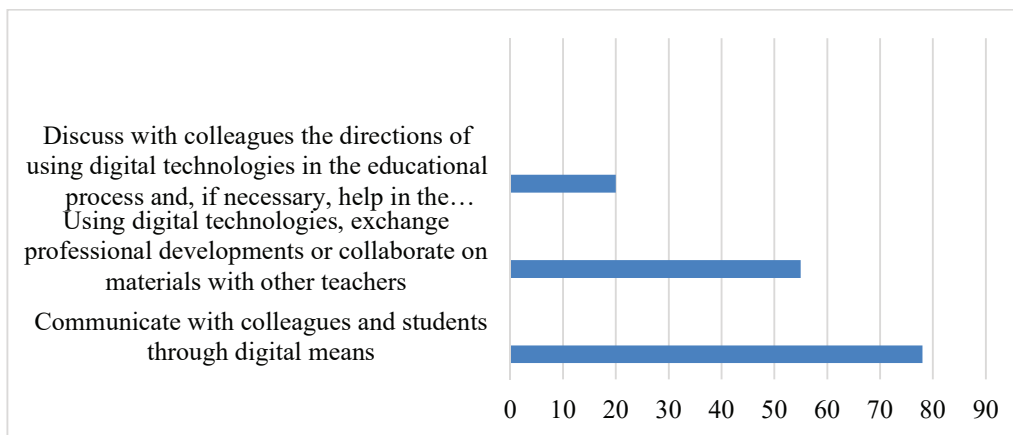
Figure 1. The results of the professional duties of teachers in the context of the spread of digital technologies

2. The ability of teachers to select, develop, and alter *digital resources*, as well as share them in accordance with learning objectives, is implied. According to the survey, 45% of participants compare and choose online resources based on specific criteria and are willing to offer advise to colleagues in this area. 48% of respondents said they either produce new educational materials from scratch or adapt ones that already exist. At the same time, only 25% of educators utilize security measures like encryption and passwords to safeguard data in a digital setting. It might be inferred that they are either unqualified or have little interest in safeguarding private information (Figure 2).
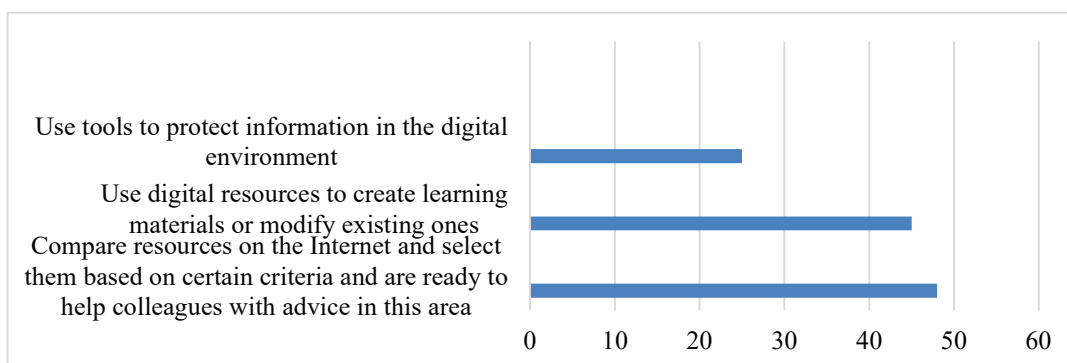

Figure 2. The results of teachers' ownership of digital resources

3. The ability of a *teacher to design, organize, and apply digital technologies* at various learning stages is essential for both teaching and learning. The student must be at the heart of the learning process, as was already established, and the teacher should serve more as a tutor. The study's findings revealed that teachers actively employ digital tools to plan students' education (Figure 3).
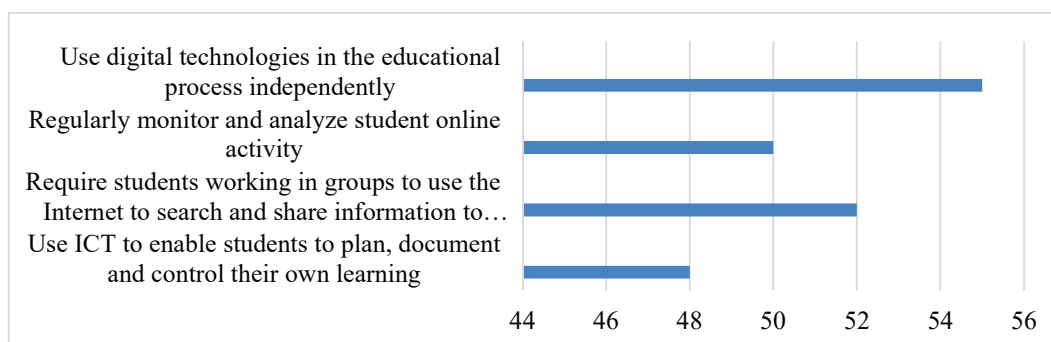

Figure 3. Indicators (%) use of digital technologies by teachers in the process of organizing student learning

4. Digital technologies are used to integrate current *student assessment* techniques, give students feedback, and analyze their online behavior when conducting student assessments. In our study, we discovered that 50% of educators utilize digital tools to evaluate and monitor the development of their students, and that nearly half (48%) also use them to give feedback to the pupils. And 35% of respondents do this on a regular basis to identify which pupils require further help and support (Figure 4).
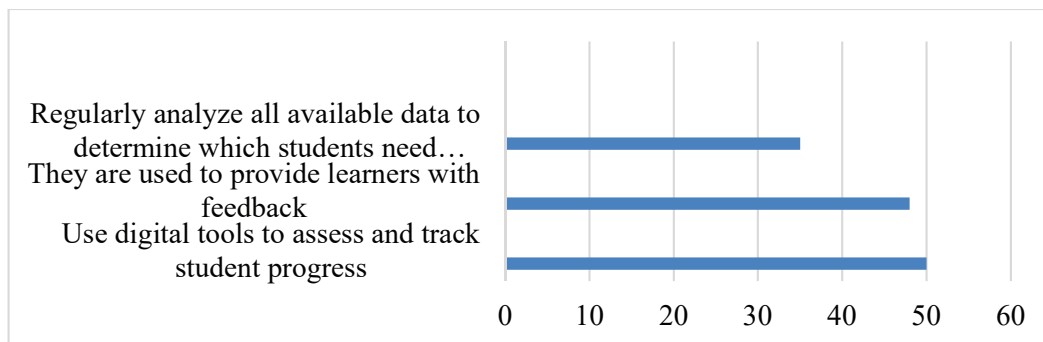

Figure 4. Indicators (%) use of digital tools to implement existing student assessment methods

5. The use of digital technology by teachers to create individualized learning paths for students as well as the abolition of differentiation in students' access to suitable technical equipment are both necessary for the *empowerment of students' rights, opportunities, and independence in the educational process*. According to the poll, only 35% of teachers talk with their students potential issues related to their availability of digital devices required for performing educational activities and attempt to identify solutions. In addition, a third of educators (or 30%) employ digital tools to make sure that the educational process fully accommodates each student's unique demands.

6. A significant part of a teacher's digital competence is their ability to help pupils *develop their digital literacy*, and many survey participants stated that they engage in this kind of work. It is clear that most teachers give their pupils assignments that allow them to improve their digital literacy, and one-third of them (78%) actively encourage this. Teachers' efforts are focused on teaching pupils about digital technology security (65%) and evaluating the veracity of the information received (75%; Figure 5).
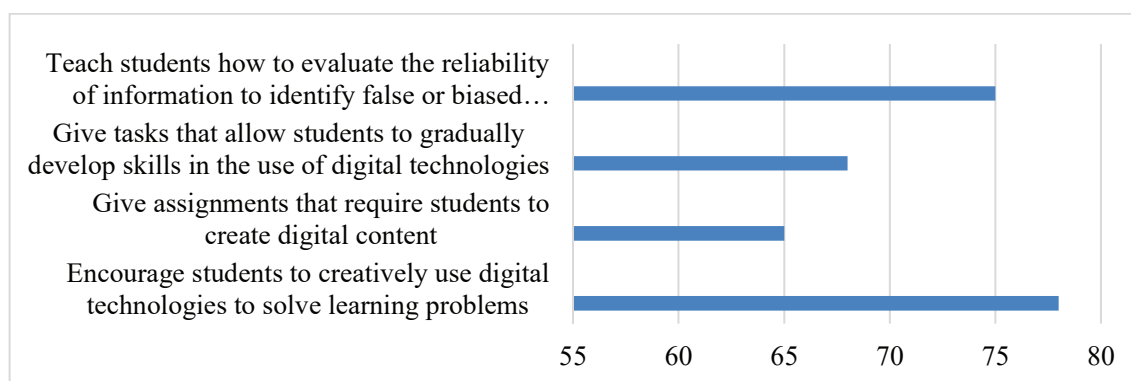

Figure 5. Indicators (%) of respondents' answers in the block «Development of digital literacy of students»

Based on the results of the analysis of six modules, it can be concluded that the teachers demonstrated an average level of digital ICT proficiency, but at the same time, there is a tendency to increase professionalism and interest in development in this area.

Discussion. As part of the study, the structure of the model of digital competencies of teachers

is proposed, the functional part of which contains blocks: conceptual (goals, objectives, principles, and content of education), technological (algorithm for designing a trajectory, creating a digital educational environment, teaching methods), criteria (levels and descriptors of competencies), reflective.

The content is represented by blocks-modules of digital competencies (Fig. 6).

Module 1. Digital tools and resources. Use of technological equipment. Electronic portfolio of teacher and student. Digital profile.

Module 2. Digital technologies of interaction. Digital assistants: instant messengers, forums, chats. Digital tools for group work: interactive whiteboards, and video conferencing services.

Module 3. Online educational services. Network interaction. Organization of educational projects, distance olympiads, and competitions. Gamification. Quizzes, quests.

Module 4. Digital technologies of e-learning. Distance learning course. Creation of a digital educational environment. The constructor of lessons, tests, and sites for creating educational content. Cloud technologies in education.

Module 5. Digital assessment technologies. Digital Services and Formative Assessment Tools. Learning analytics and visualization of learning outcomes. Trainers.

Module 6. The digital culture of the teacher. Flipped class. Blended learning. Learning management systems. Augmented reality technologies. Organization of an educational event.

Module 7. Development of a digital culture of students. Creation of digital content. Rules of digital etiquette. Security in the digital space.

The algorithm for constructing an individual educational trajectory involves the following sequence of actions:

1. Diagnostics of the initial level of the teacher's digital competencies in seven areas of the content structure of the digital competencies model in three areas (knowledge, skills, motivation);

2. Visualization of the results using Excel and the formation of an individual profile of the teacher's digital competencies, identification of priority areas for development;

3. Allocation of modules of the training program, the level of development of competencies;

4. Determination of the ways of studying, the methods and technologies of teaching used, and the forms and means of monitoring the results;

5. Coordination of the study of the module, correction of progress along an individual educational trajectory;

6. Formation of a portfolio with the results of educational activities;

7. Diagnostics of the achieved level of digital competencies of the teacher;

8. Reflection, analysis of results;

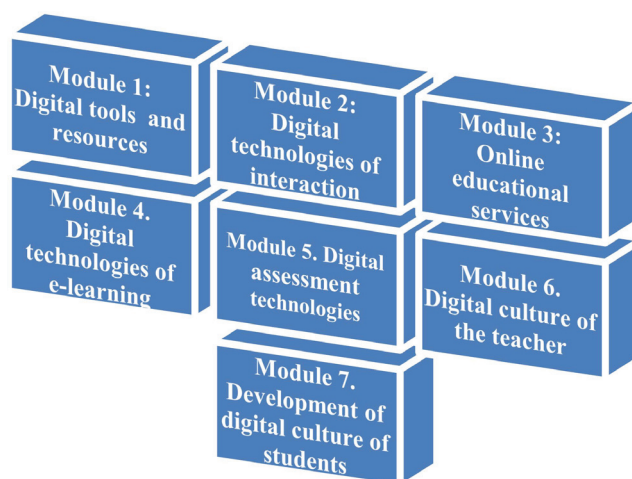9. Determination of directions for continuing education, a new cycle.

Figure 6. The content of digital competencies in blocks-modules

Conclusion. The proposed model of the continuous development of digital competencies of teachers allows to characterize managerial activities for the development of the digital

potential of an organization, reveals the mechanism for eliminating the difficulties of teachers with an insufficient level of digital competencies, solves the problems of differentiation of methodological support for teachers, and increase the level of readiness of teachers to change pedagogical practices.

The challenges of Industry 4.0 determine the importance of developing universal competencies that include both behavioral and digital skills.

This combination will create a unique competitive advantage for a person and an organization, determining success in the digital economy. At the same time, a high level of development of digital competencies will ensure the necessary efficiency of people's activities in all spheres of life.

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