THE TEACHER IN THE SYSTEM OF DEVELOPING STUDENTS' DIGITAL COMPETENCE

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Abstract: *Higher education institutions must provide training for a graduate who has a high level of digital competence. Such training can be implemented in the digital educational environment of a higher education institution. The article describes the essence of the concept of "digital competence". European and domestic approaches to the study of the formation of digital competence of specialists are analyzed. Teachers of higher education institutions play an important role in the development of digital competence of future teachers. The digital educational environment requires from them a different approach to the organization of the educational process, the acquisition of new skills and abilities to work in the digital educational space. In this context, it is necessary to develop a strategy for preparing teachers to work in the digital educational environment. The Ternopil Volodymyr Hnatiuk National Pedagogical University Center for Digital Transformation of the Educational Environment conducted a survey of teachers to assess the level of their own digital competence and readiness to work in the digital educational environment. The authors describe the process of implementation of the program for the development of digital competence of teachers at Ternopil Volodymyr Hnatiuk National Pedagogical University.*

Keywords: digital competence; digital technologies; digital transformation; digital educational environment; teacher.

INTRODUCTION

Today, the world is undergoing a digital transformation of education. Digital tools are not only tools, but also the environment for living of modern person. They open wide opportunities for improving the educational process, the organization of distance, blended and lifelong learning. Digital transformation of the educational environment requires from teachers a different approach to the organization of the educational process, the acquisition of new skills and abilities to work in the digital educational space. It is higher education institutions that should provide training for graduates with a high level of digital competence. The future teacher during the training should gain skills and abilities to organize and work in the digital society, the ability to form an individual educational trajectory using digital tools and resources. Such training can be implemented in the digital educational environment of a higher education institution. A teacher of specialized and professional disciplines plays an important role in this training.

Methods

To achieve this goal, a set of theoretical methods was used: analysis of scientific sources on the research problem, separation of the conceptual apparatus of research, synthesis, generalization, systematization to substantiate the theoretical aspects of digital competence of teachers. Empirical research methods were used to determine strategies, regulations for the organization of e-learning and the development of digital competence of teachers.

BACKGROUND RESEARCH

Citizens of European countries and many countries in other parts of the world live in a digital society – a society heavily filled by digital technologies. Information society technologies are defined as offering services based on the use of digital technologies, the Internet, digital content, electronic media. Digital society is where digital transformation of all processes, an important link among which is education, is taking place.

The digital transformation of Ukrainian education is taking place in accordance with national and European regulations. These regulations substantiate the requirements for the digital transformation of education and the development of digital competence of professionals.

In 2018, the European Parliament and the Council of the EU adopted the Framework Program on renewed key competences for lifelong learning (2018/C 189/01), in which digital competence is recognized as one of the eight key competences for a full life and activity of citizens. Digital competence is defined as the confident and critical use of information society technology for work, leisure, study and communication. The European Framework for the Digital Competence of Educators (DigCompEdu) considers 22 competences (Redecker, 2017). They are grouped into six areas: professional environment; search, creation and sharing of digital resources; management and use of digital tools in teaching; digital tools and learning assessment strategies;

use of digital tools to develop students' abilities; development of digital competence of students.

In the Concept of the New Ukrainian School, information and digital competence is one of the most important among the ten key competences. It involves the confident, but at the same time critical, use of information and communication technologies (ICT) for the creation, searching, processing, exchanging of information at work, in public space and private communication (information and media literacy, basics of programming, algorithmic thinking, working with databases, Internet security and cybersecurity skills, understanding the ethics of working with information (copyright, intellectual property, etc.) (Ghrynevych et al., 2016).

The professional standard of a teacher of a Ukrainian general secondary education institution defines information and digital competence as one of the teacher's key competences. It includes the ability to navigate in the information space, to search and critically evaluate information, to operate it in professional activities. The modern teacher must effectively use available and create new electronic digital educational resources (Professional standard, 2020).

According to the Concept of development of digital competences, the rapid development of digital technologies and the introduction of innovations in all areas require improving the quality of the training of modern professionals and modernization of all areas to fulfil modern requirements of the digital society. The development of a system for the growth of digital competence of specialists and a system of indicators for monitoring the level of development of digital competence are the main problems in the development of digital competences facing the education in Ukraine (Concept, 2021). Therefore, in the context of digital transformation of education, it is important to form, support and develop digital competence of future teachers. This will contribute to achieving the required level of competitiveness of the specialist in the labour market, their adaptation to the digital society. Possession of digital skills will ensure the use of new digital resources by teachers, which will help to improve the quality of education.

Peculiarities of development of digital competence of a specialist, formation and measurement of digital competences have been considered in research.

Krumsvik defined digital competence as the mastery of teachers to use information technology in their professional activities (Krumsvik, 2011). According to Scuotto and Morellato, digital competence is the ability to flexibly research and solve new technological situations, analyse, select and critically evaluate data and information, use digital potential to solve problems (Scuotto, Morellato, 2013). According to Gutierrez's research, digital competence is seen as values, beliefs, knowledge, the ability to use digital technologies to acquire knowledge (Gutierrez, 2011).

Ferrari considered digital competence in the set of knowledge, skills, strategies on digital technologies that are needed to take on tasks, solve problems, communicate, manage information, collaborate, create and share digital content (Ferrari, 2012).

Digital competence helps professionals to acquire other key competences, such as language, mathematics, cultural awareness (Mattila, 2015).

O. Kuzminska, N. Morze, H. Henseruk, E. Smyrnova-Trybulska, O. Spirin considered the issues of formation of teachers' digital competence (Smyrnova-Trybulska,

2018; Morze, 2017). V. Bykov noted that the teacher's digital competence is knowledge, skills and abilities in the field of information technology and the ability to apply them in professional activities (Bykov, 2008).

The digital competence of the pedagogical worker should ensure the development of all its components: from media literacy to processing, critical evaluation of data, security and cooperation on the Internet (Morze, 2019). The modern teacher must be able to use open resources and technologies for professional development, to form in students the ability to effectively use digital technologies to solve various problems and tasks.

Thus, digital competence is considered important for modern educators. It helps teachers acquire and update the skills needed for their professional activities.

In higher education institutions, it is necessary to design a digital educational environment to implement a strategy for the development of future teachers' digital competence.

1. LEVEL OF THE DIGITAL COMPETENCE OF TEACHERS AT TERNOPIL VOLODYMYR HNATIUK NATIONAL PEDAGOGICAL UNIVERSITY

An important role in the development of digital competence of students in the digital educational environment of higher education is assigned to the teacher. Modern teachers must be able to apply various digital tools and resources in their professional activities. The process of interaction between teachers and students is changing. The teacher becomes a tutor who accompanies the trajectory of student training.

A digitally competent teacher must be able to encourage students to actively participate in all processes of the digital society. They should play an important role in the process of achieving high learning outcomes by students and be an example of how to properly and critically use digital technology in the learning process. At the same time, the teacher needs to learn and constantly develop their own digital skills.

It is important in the context of our study to determine the level of development of digital competence and readiness of teachers to work in the context of digital transformation of education.

The development of digital competence of future professionals is one of the main tasks in the planning and developing of digital educational environment of Ternopil Volodymyr Hnatiuk National Pedagogical University (Henseruk, Buyak et al., 2020). To implement this task, a strategy for the development of digital competence of future teachers has been developed. An important place in it is given to the teacher of the educational program, which is acquired by the future teacher. The development of digital competence of future professionals takes place in the process of studying digital and professional disciplines. In this context, it is necessary to prepare teachers for the use of digital technologies in the educational process and the introduction of new modern forms of learning.

At the beginning of 2020, the Centre for Digital Transformation of the Educational Environment at Ternopil Volodymyr Hnatiuk National Pedagogical University con-

ducted a survey of teachers to assess the level of their own digital competence and readiness to work in the digital educational environment. 225 teachers took part in the survey. The survey was conducted in accordance with the the European Framework for the Digital Competence of Educators, which contains six modules (Figure 1).

Professional responsibilities of teachers in the use of digital technologies	Digital resources	Teaching and learning
Learning assessment	Empowering students	Development of digital competence of students

**F i g u r e 1. The Modules of the European Framework
for the Digital Competence of Educators**
S o u r c e: Own work.

The professional responsibilities of teachers in the use of digital technologies are expressed not only in the readiness to use them in the educational process. They are defined as a willingness to cooperate in learning, the ability to communicate and develop yourself in a digital environment.

According to the survey, only 25% of respondents communicated with colleagues and students using digital means. 28% of teachers used digital technologies to share professional materials and work with other teachers. 30% of respondents communicated with colleagues using digital technologies. Thus, only a third of teachers used digital technology for communication, collaboration and professional development.

The module "Digital Resources" includes the ability of teachers to choose digital tools and create their own materials using them. According to the survey, 35% of teachers selected digital resources on the basis of certain criteria and critically evaluated them. 38% of respondents used digital tools to create training materials or modify existing ones. However, only 20% of teachers used tools to protect information in the digital environment.

"Teaching and learning" includes the teacher's ability to create, plan and implement digital technologies at different stages of educational activities. Student-centred learning is important. The student should be at the centre of the learning process, and the teacher himself will act as a tutor. According to the survey, only 31% of teachers actively used digital technologies in the process of organizing student learning. The Covid pandemic has made adjustments to the organization of the educational process. It was necessary to move from the traditional format of classes to mixed forms of learning by actively including in the educational process various digital tools and online courses.

"Learning assessment" involves the use of digital tools for the implementation of existing methods of student assessment, the introduction of formative assessment.

It involves providing students with feedback and analysis of their activity in the digital environment. 40% of respondents used the LMS Moodle platform to assess and track student progress. However, only 25% of respondents used digital tools to organize formative assessment.

The module "Empowerment of students" involves the use of digital technologies by teachers to build an individual trajectory of students. It is important to eliminate differentiation in their access to appropriate technical devices and digital resources. According to the survey, only 32% of teachers discussed with students the possible problems that arise when performing learning tasks using digital devices. 30% of respondents used digital technology to organize the learning process that would best meet the individual needs of students. 39% of teachers used digital technologies to involve students in the educational process. However, these were mainly presentations, educational videos, rarely electronic tasks and educational games.

Important in the context of our study were the results of a survey of teachers on the module **"Development of digital competence of students"**. This is an important component of digital competence of the teacher. One third of the respondents who took part in the survey confirmed that they carry out this type of activity (Figure 2).
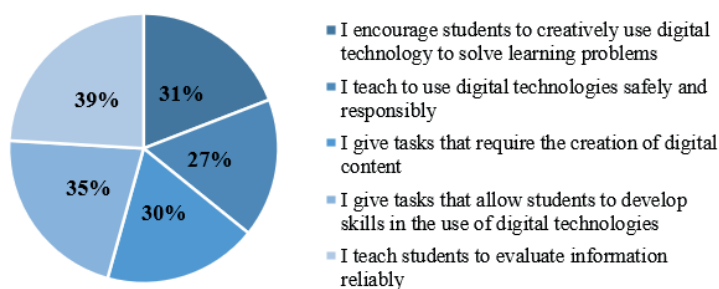

F i g u r e 2. The module "Development of digital competence of students"

S o u r c e: Own work.

Part of teachers (30%) gave students tasks that allowed them to develop their digital competence. 27% of teachers discussed safety with students while working with digital technologies. 39% of respondents assessed the reliability of the received information. Thus, according to the results of the study, teachers demonstrated a sufficient level of mastery of digital technologies. However, there was a trend of growing interest in the use of digital technologies in the educational process.

2. PROGRAM FOR DEVELOPMENT OF THE DIGITAL COMPETENCE OF TEACHERS AT TERNOPIL VOLODYMYR HNATIUK NATIONAL PEDAGOGICAL UNIVERSITY

The digital transformation of education in Ukraine, the rapid development of digital technologies, the transition to distance and blended learning have changed approaches to the organization of the educational process at Ternopil Volodymyr Hnatiuk National Pedagogical University. During 2020–2021 there was a digital transformation

of traditional approaches to learning in the process of implementing the strategy of digital educational environment of the university.

The Centre for Digital Transformation of the Educational Environment studied and developed modern strategies for the development of digital competence of teachers and students of the university.

The development of the model of the program of digital competence growth of teachers at Ternopil Volodymyr Hnatiuk National Pedagogical University was carried out in several stages (2020–2021). The analytical phase included the study of experience, analysis and comparison of teacher training systems in the digital educational environment in European countries. The second stage was the stage of modelling. At this stage, a theoretical model of the program for the development of digital competence of the teacher was designed.

In the course of the research, the following principles of development of the teacher's digital competence have been determined:

- coordination of the development program with the main trends in the development of education at the global and European levels;
- coordination of the development program with the tendencies of digital transformation of education in Ukraine;
- use of relevant modern theories in the context of e-learning;
- correspondence of the development program with the European system for the Digital Competence of Educators DigCompEdu;
- compliance of the development program with the standard "Teachers of higher education institutions".

Program for the development of digital competence of teachers at Ternopil Volodymyr Hnatiuk National Pedagogical University includes:

- wide opportunities for formal, non-formal and informal teacher education;
- methodical support, information support, stimulation of teachers.

The development of digital competence of the teacher at all stages took place continuously in accordance with the individual abilities of every person, their needs and creative potential.

The Centre for Digital Transformation of the Educational Environment together with The Centre of Distance Learning conducted a series of training courses and seminars on the development of digital competence of teachers on the organization of the educational process in terms of distance and blended learning. The content of seminars and training courses was formed in accordance with the professional affiliation of teachers and the peculiarities of the organization of the educational process of a particular educational program.

Topics of the training and seminars:

- Digital tools in the professional activities of the teacher.
- Digital tools for communication in the e-learning process.
- Technologies for recording and editing video lectures.
- The art of computer presentation.
- Digital tools for formative assessment.
- Digital gaming tools.
- Tools for creating digital content.

For each seminar, guidelines for the use of a specific digital tool were developed. During the seminars, proven methods of conducting classes in the process of blended learning were shown for teachers. Particular emphasis was placed on the module "Development of the digital competence of students." Teachers were offered an example of tasks that can be given to students to develop their digital competence. Such tasks promote the development of soft skills.

As an example, a task "Creating a chronological historical event" was proposed for humanities students. Task text: "Simulate the event of the Revolution of Dignity using digital tools to create knowledge maps."

Teachers of professional disciplines also offered students tasks that involved the use of digital tools. It is worth noting, that educators do not have to be able to work with a certain digital tool. To formulate tasks, they need to know the capabilities of a particular digital resource and clearly describe to students the content of the task.

Below is an example of an interactive video on the study of a certain topic of the discipline "Lexicology" of the educational program "Secondary education (English language and literature)" (Figure 3). The task was created by a third-year student of the first (bachelor's) level of higher education.

At the next stage of the study, we developed a questionnaire for teachers to identify the dynamics of their digital competence. The questions of the questionnaire also concerned digital means and tools for organizing the educational process.

In addition to the Ternopil Volodymyr Hnatiuk National Pedagogical University e-learning system (Moodle platforms), teachers (86%) began to use various digital tools more often in the organization of the educational process. It is worth noting the use of tools and services of digital tools in the educational process at different stages of the lesson and for different purposes.

Most often, teachers use digital tools in lectures (60.9%) and practical classes (65.2%), less often in seminars (38%) and laboratory classes (25%). 2.2% of teachers use digital tools during other classes.

F i g u r e 3. The example of a task created by students using the Powtoon digital tool

S o u r c e: Own work.

For joint work with students in the process of distance learning teachers used platforms for online classes: Zoom, Google Meet, BigBlueButton (98.9%); Google services: Google Docs, Google Presentations, Google Spreadsheets, Google Surveys, Google Class (57.6%); electronic boards: Padlet.com, Miro.com, Jamboard.com (32.6%).

Digital technologies have changed the approaches and criteria for assessing student achievement. It is important today to use the method of formative assessment, which allows students to understand and track their own progress and create their own learning trajectory, 82.7% of teachers used the resource Mentimeter, Socrative and Wordwall in formative assessment, 12.3% – Learningapps, 5% – other digital tools. 33.7% of teachers used electronic boards for feedback for classes outside Moodle: Padlet.com, Miro.com, Jamboard.com, 46.7% – other digital tools, 19.6% – do not use at all. It is worth noting, that 33.7% of teachers use the Mentimeter tool and 16.3% – Kahoot.

The number of teachers who offered homework and individual creative projects involving the use of digital technologies has significantly increased. Such tasks contributed to the formation of such skills: the ability to think critically, solve problems creatively and easily adapt to the process of digital transformation of society. 71.6% of teachers offered this type of task in the form of interactive presentations, 38% – in the form of interactive videos, 33.7% – in the form of mind maps, blocked diagrams on various topics, chronology of events, 31.75% – in the form of infographics. (Figure 4).
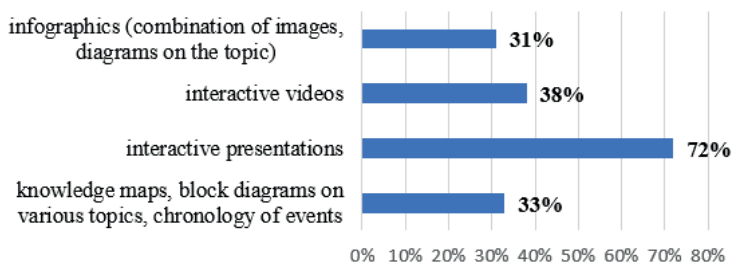

F i g u r e 4. Digital tools for students to complete tasks

S o u r c e: Own work.

90.2% of respondents used Viber, 84.8% – e-mail, 31.5% – Messenger, 23.9% – Telegram, 10.9% – Skype to communicate with students.

All digital tools mentioned in the survey were considered by the teachers as the most effective in improving the quality of the educational process. In their opinion, everything depends on the type of lesson and its topic. The university teacher plays an important role in the functioning of a high-quality open digital educational environment of the university, in which the development of digital competence of students takes place.

CONCLUSION

In order to prepare competitive teachers, it is necessary to introduce a system of development of their digital competence in a higher education institution. An impor-

tant place in this system is given to the university teacher, who should promote the development of digital competence of students. For this purpose, it is efficient to talk about designing the digital educational environment of the educational institution, creating a professional program for the formation of the digital competences of both teachers and students. This environment should be created in accordance with the following principles: defining who learns as an active subject of educational process; their focus on self-education, self-development; accounting their individual characteristics, training in the context of future professional activity.

The digital competence of a teacher of a higher education institution goes beyond the specific use of digital technologies in teaching. The digital transformation of the system of advanced training modern teachers is important to achieve a high level of their digital competence.

The Centre for Digital Transformation of the Educational Environment at Ternopil Volodymyr Hnatiuk National Pedagogical University has developed special courses for the development of digital competence of teachers. The courses significantly enriched the teacher's knowledge, which is confirmed by the survey.

REFERENCES

B y k o v, V. (2009). *Models of organizational systems of open education.* Kyiv: Attica. ISBN 978-966-326-317-5 [in Ukrainian].

F e r r a r i, A. (2012). *Digital competence in practice: An analysis of frameworks.* Sevilla: JRC IPTS. ISBN 978-92-79-25093-4, ISSN 1831-9424, https://doi.org/10.2791/82116.

G h r y n e v y c h, L., E l j k i n, O., K a l a s h n i k o v a, S., K o b e r n y k, I., & K o v t u n e c j, V. (2016). *New Concept of the Ukrainian School.* Retrieved from https://mon.gov.ua/storage/app/media/zagalna%20serednya/nova-ukrainska-shkola-compressed.pdf (accessed 8 June 2021) [in Ukrainian].

G u t i e r r e z, I. (2011). Competences of university teaching staff in relation to the use of information and communication technologies: analysis of the situation in Spain and proposal of a training model (Doctoral dissertation). Universitat Rovira i Virgili, Tarragona, Spain.

H e n s e r u k, H., B u y a k, B., K r a v e t s, V., T e r e s h c h u k, H., & B o i k o, M. (2020). Digital transformation of the learning environment at university. In E. S m y r n o v a - T r y b u l - s k a (Ed.). *Innovative Educational Technologies, Tools and Methods for E-learning. Series on E-learning. 12.* Katowice–Cieszyn: STUDIO NOA for University of Silesia. ISSN 2451-3644 (print edition), ISSN 2451-3652 (digital edition), ISBN 978-83-66055-19-3, https://doi.org/10.34916/el.2020.12.28.

K r u m s v i k, R. (2014). Teacher educators' digital competence. *Scandinavian Journal of Educational Research, 58*(3), 269–280. https://doi.org/10.1080/00313831.2012.726273.

M a t t i l a, A. (2015). The future educator skills in the digitization era: Effects of technological development on higher education. *Fifth International Conference on e-learning.* In e-Learning (econf). https://doi.org/10.1109/ECONF.2015.18.

M o r z e, N. & B u y n i t s k a y a, O. (2017). Increasing the level of information and communication competence of scientific and pedagogical workers – a key requirement for the

quality of the educational process. *Information Technologies and Learning Tools, 59*(3), 189–200. https://doi.org/10.28925/2414-0325.2017.3.89s9 [in Ukrainian].

Morze, N., Bazeliuk, O., Vorotnikova, I., Dementiievska, N., Zakhar, O., Nanaieva, T., Pasichnyk, O., & Chernikova, L. (2019). Description of educator's digital competence. *Open educational e-environment of modern University, Special edition „New pedagogical approaches in STEAM education"*, 1–53. https://doi.org/10.28925/2414-0325.2019s39 [in Ukrainian].

Professional standard of a teacher of a general secondary education institution (2020). Ministry of Education and Science of Ukraine [in Ukrainian].

Redecker, C. *European Framework for the Digital Competence of Educators: DigCompEdu.* Punie, Y. (Ed.). EUR 28775 EN. Publications Offce of the European Union Luxembourg, 2017. 95 p. ISBN 978-92-79-73494-6, ISSN 1831-9424, https://doi.org/10.2760/159770.

Scuotto, V. & Morellato, M. (2013). Entrepreneurial knowledge and digital competence: Keys for a success of student entrepreneurship. *Journal of the Knowledge Economy, 4*(3), 293–303. https://doi.org/10.1007/s13132-013-0155-6.

Smyrnova-Trybulska, E. (2018). Technologie informacyjno-komunikacyjne i e-learning we współczesnej edukacji [Information and Communication Technologies and E-learning in Contemporary Education]. Katowice: Wydawnictwo Uniwersytetu Śląskiego [University of Silesia Press]. ISSN 0208-6336, ISBN 978-83-226-3070-9 (print version), ISBN 978-83-226-3071-6 (digital version).

The concept of digital competence development (2021). Retrieved from https://zakon.rada.gov.ua/laws/show/167-2021-%D1%80#n93 (accessed 17 June 2021) [in Ukrainian].