

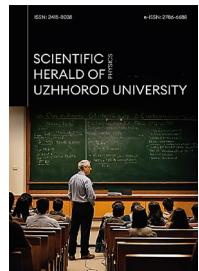
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## Problems in developing the digital competence of modern future teachers in the context of globalisation

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### Abstract

**Relevance.** This study examines one of the most important problems of modern information society – the relevance of information and communication technologies, being elements found in many situations in the public environment.

**Purpose.** The authors of this study were theoretically able to focus on the studied digital competence in the context of globalisation and, based on the works of scholars, show the possibilities of improving the conditions of future teaching staff from the most important scientific-theoretical-methodological point of view.

**Methodology.** To achieve this reality, by making an effort towards digital competence in the context of globalisation and achieving the expected results, using information and communication technology (ICT), it is possible to direct the work towards advancement.

**Results.** Digital competencies, digital literacy and the level of digital knowledge development are formed during distance learning, the best ways to apply digital skills are discussed, and relevant information and skills in the field of digital literacy are demonstrated.

**Conclusions.** Nowadays, the approach to the issue of new technology is changing dramatically – both reality and virtuality have become an integrated whole. A digital world has emerged that is changing human activities and lives. In today's society, one wants to become a user of the virtual space or a specialist who supports it. The close relationship between

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reality and virtuality gives our modern times features such as homogeneity, complexity, flexibility, mobility, speed, paradox and uncertainty, which have replaced balance and stability.

**Keywords:** global technology; competence; digital competence; digital literacy; digital education; ICT competence; process.

## **Introduction**

In today's space, a digital world has emerged. The modern approach to this issue is changing dramatically. Therefore, according to the new requirements, future teachers should be able to master information technology and be able to plan and implement their personal and professional development. The new requirements thus aim to develop digital competence and encourage students to strive for self-development. In particular, training future teachers to develop 21st century skills with educational programmes that will enable learners to work in a digital and global society.

Thus, in society, a person should be a user of the virtual space or a specialist who maintains it. The notion of "literacy", which has always bound the information society. Education primarily one of the three most important competences – the unit of reading, writing and numeracy – has expanded its boundaries considerably. The concepts of "computer literacy", "information literacy", "media literacy" and "ICT competence" have emerged and are being actively developed within the framework of the education system [1; 2]. In this regard, there is a question which comes first – digital literacy or academic literacy? From this point of view, it is absolutely clear that creating a new school is about teachers who have the necessary conditional digital literacy, or in a broader sense, digital competence, and who skillfully use these competences to develop academic and digital literacy of future specialists.

Digitalisation efforts will therefore lead to the creation of a new society in which human capital is actively developed – the knowledge and skills of the future will be nurtured from an early age, automation and other new technologies, and the dialogue of citizens with their states will be simple and transparent. The digital revolution is taking place in front of us too. These changes have been prompted by the introduction in recent years of many technical innovations used in various fields. These changes are fundamental and do not take place over decades as much as before, but even within a few months. The pace of change is increasing, but it is not too late to become part of it. Nowadays, the process of digitalisation affects every country in the world. In doing so, each country determines its own priorities regarding digital development. More than 15 countries are now implementing national digitalisation programmes [3].

The unstoppable development of technologies requires a search for answers to the questions of inclusion in the educational process from a pedagogical point of view: analysis of theory, creation of curricula, initial and continuous training of future teachers, basics of teaching and methodological application of technology in teaching and learning, among other analyses, an important scientific production that distinguishes Spanish publications [4; 5]. To deepen the current state of the issues related to teaching digital competence, a consultation analysis of exploratory research aimed at teachers, especially their knowledge,

attitudes and issues related to the application of technologies [6; 7].

What is digital competence? This indicates that, if existing definitions are actively analysed, the concept of digital competence is one of the new definitions being formed. It is constantly changing in line with the development of modern information and communication technologies [8]. Many authors refer to the concept of digital competence as the ability and skills to use digital technologies effectively in everyday life, abilities and skills to critically evaluate technologies, motivation and emphasise that they are relevant to digital culture, as well as technical skills, often related to computer literacy [9-11].

Further development of digital competence is an understanding of digital culture and digital citizenship. Digital culture is today part of the everyday culture of an information society citizen, and it should be regulated by both laws and ethical norms, as well as by security rules developed in cooperation with the citizens of that society [12; 13].

The purpose of the study is to present the results of testing the methodology of developing digital competence of future teachers in the course of an online lesson and the ability to use the Internet, to improve the level of digital competence through ICT resources. The suggested methodology (diagnostic tools carried out) corresponds to the selected indicators in the development of digital competence.

The following tasks are highlighted to guide the study:

- to determine the digital mastery of future specialists in education;
- to know the group of students with a high level of digital education (competition);
- to determine the academic qualification degrees of students (technological forecast);
- to identify the level of technological nature at the stage of study at which students will have a higher level of digital competence;
- to know the application of educational technologies in pedagogical contexts in the learning process.

## **Materials and Methods**

In lecture, practical (seminar) sessions online, many first- and second-year students find it difficult to compose a presentation and understand it; they do not know how to use the software on a tablet computer. Furthermore, in the course of the study it was concluded that it is important to develop students' digital competences, the abilities for the educational process using digital mobile devices (video lectures, presentations, e-textbooks, etc.). In this study, the development of students' digital competences takes place during online classes, which determined the novelty of the results obtained. In particular, technologies for finding information on the Internet, by "digital competence" is meant the ability of students to check the reliability and

criticality of using computers, mobile phones, tablets and interactive whiteboards.

In the study, therefore, students are looking for new forms and methods of obtaining meaningful information, which includes online risk, stimulating activities and developing digital competences that require technical solutions. During the ascertaining stage of the study, the insufficiency of teaching aids using information technology necessary for students to stimulate professional knowledge and activities required to develop the student's digital competence was identified. What the authors of the study observe is the presence of motivation and the need to be digitally competent, if there are still university students. In order to determine the students' entry level, a test method consisting of special questionnaires and creative tasks was carried out. More than 77% of the surveyed students were unable to complete the concepts of "digital education", "digital literacy", "digital culture", "digital competence", but showed that they had formed some views on the essence of these concepts.

Due to the current digital situation, within the framework of this study on information technologies and distance learning, the authors sought to take advantage of the opportunities of the digital age. They communicated via Webinar, conducted conversations and surveys. For webinars, the communication programmes "Zoom Video Communications", "Teems", etc. were used to organise a remote video conference, an online lecture, an online seminar, an online meeting. These programmes were conducted for students in the course of the online research activity. It turned out that the reason for conducting the experimental work is to develop the digital knowledge of future pedagogical specialists and to comprehensively understand the essence of digital competences, to master the skills of critical analysis and their practical application. Expressing their views on the development of digitally competent professionals, 90% of teacher education

students support the teaching of disciplines in online digital education.

Diagnosis of the development of digital competences used by students during online classes was based on the following criteria:

- motivational: mastery of digital internet portals; high, moderately low levels of motivation and needs for own learning and professional mastery of resources were identified;
- activity-based: free, personal and weak mastery of techniques, development of methodological skills in self-education of digital internet resources were assessed;
- creativity: the student's use of digital Internet resources; the level of ability to perform their creative tasks at a high level, to apply techniques of independent information retrieval was identified.

The number of students who took part in the ascertaining experiment was 63, of which 31 students participated in the experimental group and 32 - in the control group. Digital competence of future teachers is the process of purposeful assimilation of ICT laws and the application on its basis of digital Internet portals, digital Internet resources, various information technologies emphasises the independent application of explanatory-illustrative, interactive methods and techniques of critical analysis of problems and digital texts.

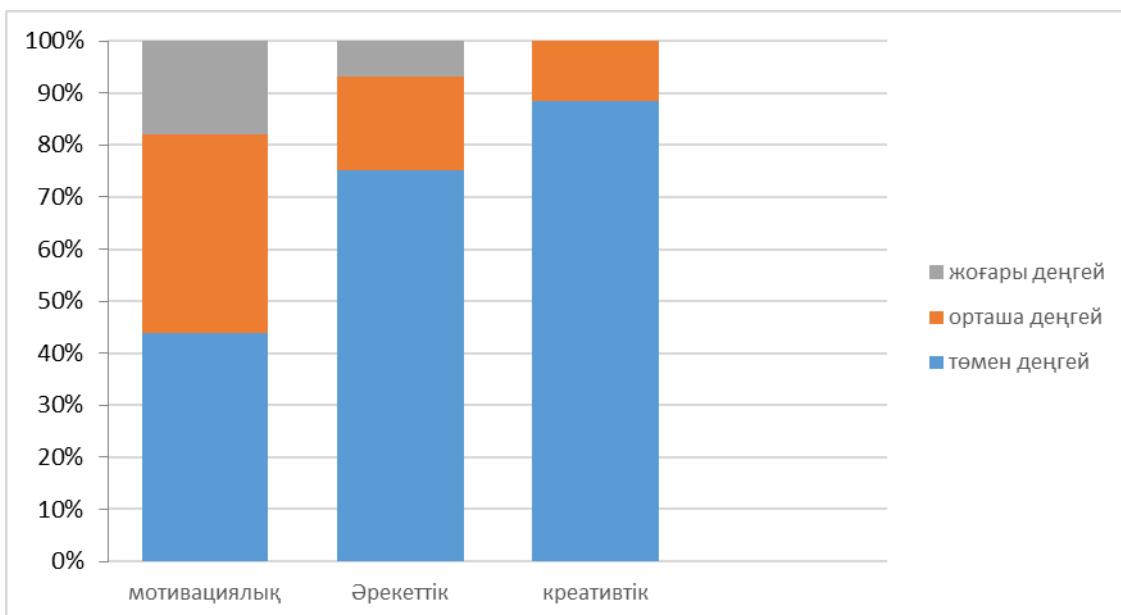
The results of the ascertaining experiment revealed that, although priority is given to mastering digital technologies, the digital education of future pedagogical specialists has not yet been established. The analysis of the findings revealed the relevance of developing digital education content and methodologies for today's digital education. By analysing the works of many academics, it has been concluded that training future teachers in digital knowledge with a division into a theoretical and a practical (seminar) part would be productive.

**Table 1.** Results of the development of students' digital competence according to the ascertaining experiment

Research groups	Control group			Experimental group		
	Criteria	Low level	Intermediate level	High level	Low level	Intermediate level
Results of the ascertaining experiment						
Motivational	40.6	35.6	16.6	34.6	44.3	17.2
Activity-based	73.1	17.4	12.8	64.4	21.8	7.1
Creative	86.5	11.4	-	83.7	14.2	-

The results obtained from the ascertaining experiment revealed a low level of digital competence of the students in both the experimental and control groups. In the motivational criterion, the group was taken below average, while the experimental group showed a high level for the activity-based criterion with 7.1%, an intermediate level

with 21.8%, and a low level with 64.4%. There was no high level indicator on the creative criterion in the control and experimental groups on the determination experiment. The results obtained by the two groups can be seen in Table 1 and in the diagrams (Figure 1) below.



**Figure 1.** Results of the digital competence formation among students in the control group according to the ascertaining experiment

This competence is based on logical thinking, a high level of information management and a high level of mastery of digital technology. The authors of the study suggest adding to this competence the following knowledge: understanding the general structure and interaction of computer devices; understanding the potential of innovative digital technologies; basic understanding of the efficiency and reliability of the information obtained, carried out in terms of the possibility to use design software. As well as creative assignments, challenging questions, etc. in an online format using digital education methodology. The students were guided by explanatory-illustrative, problem-based, heuristic research methods in enhancing digital cognitive activity.

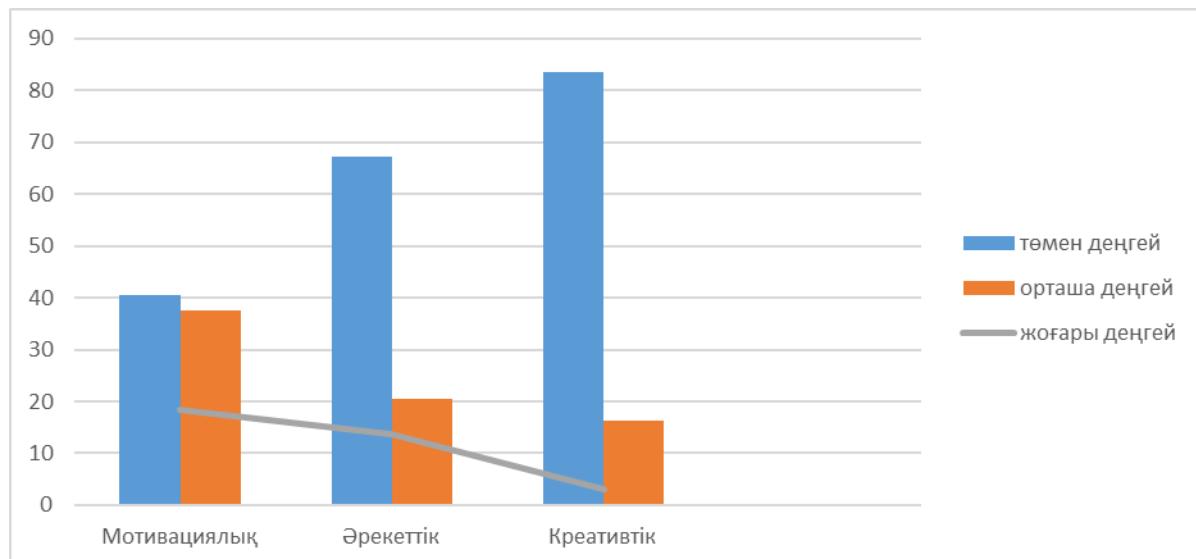
No results were recorded for digital literacy knowledge levels in the experimental and control groups according to the results of the ascertaining experiment. Whereas during the formative experiment, the results in the experimental group were slightly altered when interacting with the control group. The use of special techniques helped to improve students' performance on the motivational component. And practical assignments as well as creative independent work developing competencies for analysing digital competences improved students' performance on the activity-based, creative criteria. During the formative experiment, compared to the control group, the experimental group showed growth dynamics for all criteria. The final results obtained can be seen in Table 2 below.

**Table 2.** Results of the formation of students' digital competence in the formative experiment

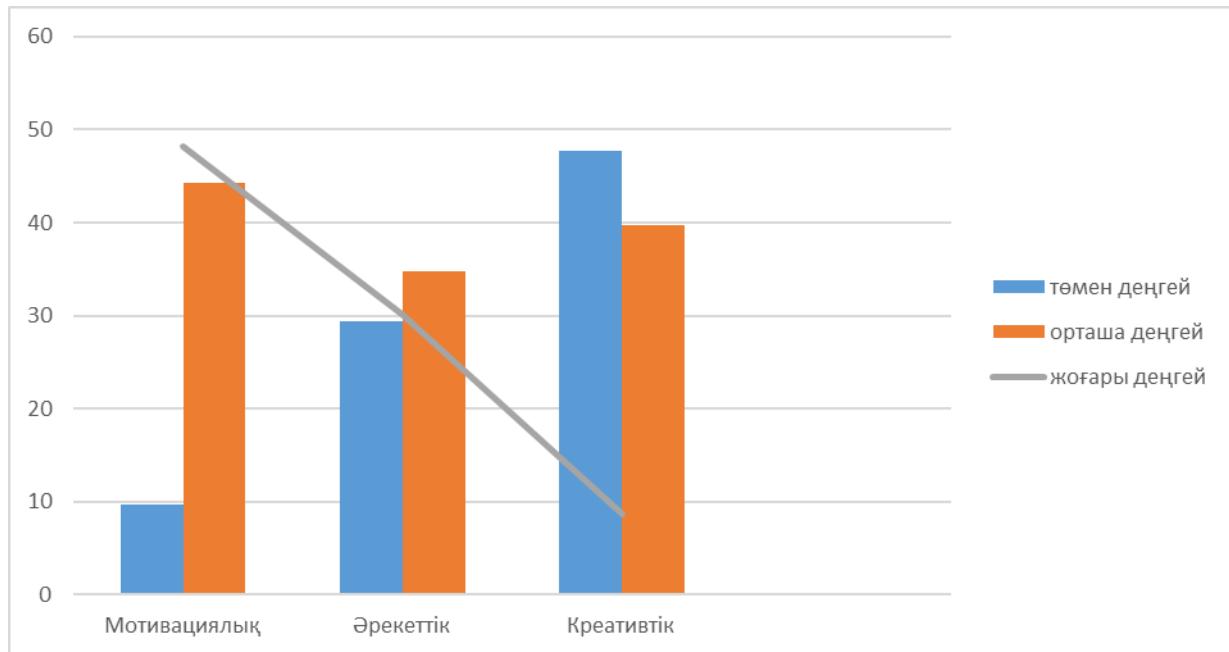
Research groups	Control group			Experimental group		
	Criteria	Low level	Intermediate level	High level	Low level	Intermediate level
Results of the ascertaining experiment						
Motivational	40.6	37.5	18.4	9.6	44.3	48.2
Activity-based	67.2	20.6	13.7	29.4	34.8	30.1
Creative	83.5	16.4	-	47.7	39.7	8.7

During the formative experiment, the experimental group achieved slightly better results. The motivation of students at a high level was 48.2%, at an intermediate level – 44.3% and at a low level – 9.6%. The results for the activity criterion were high for 30.1% of the students in the experimental group. While no high results were recorded for the creative criterion during the ascertaining

experiment, this indicator increased by 8.7% as a result of the formative experiment. In the control group, high levels were not recorded and there were no growth indicators in the intermediate level results. The results of the formative experiment in the control and experimental groups can be seen in Table 2 and in the diagrams (Figure 2-3) below.



**Figure 2.** Results of students' digital competence formation on the formative experiment (control group)



**Figure 3.** Results of students' digital competence formation on the formative experiment (experimental group)

## Results and Discussion

In the 21st century, digital competence, the quality of digital literacy and cultural communication have become the basis of the whole modern everyday life of society. Currently, any human existence beyond this evolving "media space" has reached an impossible state. All important sectors have now gone digital, which means that society demands specialists with digital competence. The changing laws of the digital society and the increasing influence of the media on personal development requires teachers to have special knowledge of information and communication technologies and the media - a key requirement of the digital age.

ICT competence and digital competence changes taking place in society are reflected in Russian and international legislation. International organisations (UN, UNESCO, World Bank, Council of Europe) and national governments have developed legal, socio-economic,

cultural and technological concepts and programmes for the transition to a digital society. With the adoption of the Digital Economy programme in August 2017, the concepts of "digital literacy" and "digital competence" were introduced. In 1997, the concept of "digital competence" was first introduced by the American writer and journalist P. Gilster. "Digital competence is the ability to understand and use information provided in a variety of formats and in the variety of information sources that computers use". According to P. Gilster, the Internet's constant presence in the realm of hypertext, allowing one to move quickly from one resource to another, forms new patterns of human behaviour, ways of seeking information and characteristics of communication.

This leads to the formation of a network mentality, the main feature of which is a high level of information and communication activity. Digital competence focuses on the social and communicative aspects of human activity. P.

Gilster highlights the following skills as criteria for achieving digital competence:

- criteria for achieving media culture;
- finding the necessary information and tools to work with it;
- skills, the ability to quickly master these tools (information competence);
- skills for communicating with other users;
- (communicative competence);
- information production in its various forms and formats;
- skills (creative competence) [14; 15].

One of the most important events in digital competence in Russia was a book that recorded the results of a nationwide survey on the "digital competence of adolescents and parents", which was published in 2013. In the book of G.U. Soldatova, the concept of digital competence is given. The structure of digital competence includes four components: knowledge, abilities and skills, motivation, responsibility (including safety) [16].

Each of the components can be implemented to a different extent in different areas of Internet activity (content, connection, technosphere, consumption). Accordingly, four types of digital competences have been defined:

1. Information and media competence – with digital information retrieval. Knowledge, skills, motivation and responsibility related to understanding, organising, archiving and critically understanding it, as well as creating information objects using digital resources (textual, visual, audio and video);
2. Communicative competence - to various forms of communication. Email, chat rooms, blogs, forums, social media; the knowledge, skills, motivation and responsibility required for different purposes;
3. Technical competence – the ability to solve various problems, including the knowledge, skills, motivation and responsibility to use hardware and software in an efficient and safe way in order to use computer networks, cloud services, etc;
4. Consumer competences – digital devices and the Internet; knowledge, skills, motivation and responsibilities that enable the solution of various everyday tasks depending on specific life situations involving the satisfaction of different needs.

According to the authors, taking into account the motivational-will and value aspects of digital competence, it opens the way to understanding the nature, structure and development possibilities of the concept of digital citizenship and serves as a basis for the development of personal self-regulation on the Internet. It is not a question of reduction here, but of increasing opportunities for people who are able and willing to make conscious and responsible choices (digital freedom of the individual). "An important component of digital competence, in contrast, is ICT competence" – creating new information

objects using creative digital resources (textual, visual, audio and video) as abilities and skills [17; 18].

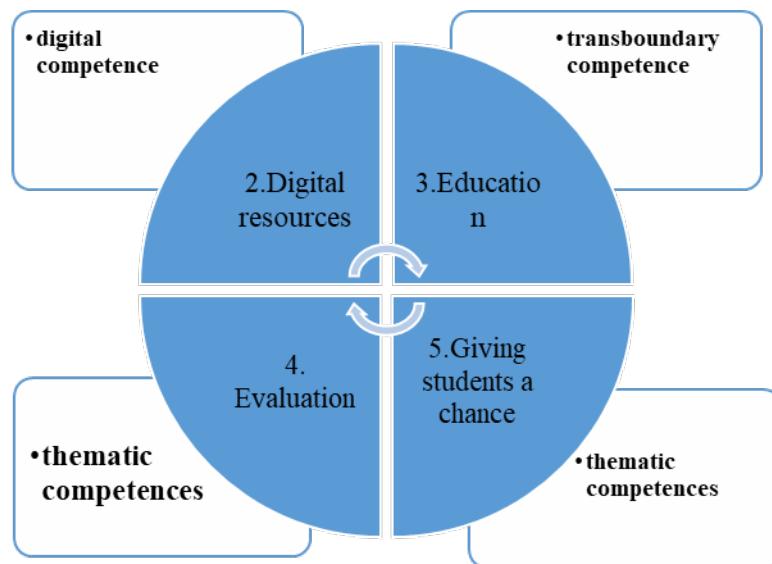
The field of ICT application acquires a special nature as a teacher's professional competence, defined by the forms of application, in order to integrate technology and educational content in solving educational and methodological problems arising in the learning process: a future educator competent in ICT should be able to manage information, create problem-related tasks, create designs according to the needs of certain contextual resources and be able to choose and use digital tools and resources wisely [19; 20].

European policy aims to provide new basic skills, demonstrating the fundamental role of digital technologies for sustainable population learning, and the importance of introducing them into the working world. For this purpose, so-called anchor points have been adopted, which serve as a basis for the development of basic skills for lifelong learning. The eight key competences for lifelong learning are defined in the EU as "a set of knowledge, skills and abilities appropriate to the context" and provide a common reference framework for decision-makers, educators, social partners and students themselves. Ultimately, it is the body of knowledge, skills and strategies a person needs to address any obstacles he or she faces in the knowledge society itself. [14; 17; 21; 22].

One of these key competences is digital competence, which "involves the reliable, critical and responsible use of technologies gained from society to work, focus and learn". The ability to use technologies for living, working and learning throughout life by any community is considered a fundamental and horizontal theme within the creation of an educational programme. From this perspective, training centres should demonstrate the benefits and importance of effectively integrating technology. Similarly, the proposal is intended to develop international education plans aimed at developing the professional skills of ordinary people and the agents responsible for their training [18].

The first steps aimed at forming a digital competence model are, firstly, the development of personal digital literacy skills, and secondly, the implementation of social-emotional adaptation processes that allow not only passive acceptance of the new digital environment, but also the implementation of successful activities in this environment.

Thus, European Union countries, in addressing such a problem, are focusing on the European model of digital competences for education (the EU framework of digital competences for education personnel). According to this model, digital qualifications form the basis of digital competence. In turn, digital skills cover two dimensions. The first component combines the skills of the user and the second component describes professional skills. Structurally, digital user skills combine several elements, which can be grouped into blocks of basic and acquired digital skills.



**Figure 1.** A blueprint for a European digital competence model of education

According to the European digital competence model of education, core digital skills include individual psychomotor skills. This is, firstly, the ability to professionally use different types of key boards that develop fine motor skills, and secondly, the ability to work with different types and sizes of computer equipment (desktop computers, laptops, tablets, Flipbox, etc.). One of the eight presented in the European Union recommendations on core competences for the acquisition of lifelong learning, dated 18 December 2006, is digital competence. According to the authors, this involves the reliable and critical use of information society technologies in all areas of life. Digital competence is based on fundamental skills in the field of information and communication technology (searching, evaluating, presenting, storing and exchanging computers, establishing communication through electronic means and the Internet) [23-25].

Since December 2010, a European Union research centre has been developing a digital competence model for the population called DigComp. Digital competence defined ICT as the reliable, critical and creative use of ICT to achieve goals related to work, education, leisure and participation in society. Digital literacy is one of the 21st century skills that all people need to have in order to actively participate in the social and economic development of society and the economy. DigComp 2.0 is represented by 21 digital competence components in five areas. The authors define digital competencies as the user's ability to confidently, effectively and safely select and apply ICT in a variety of life areas, based on the continuous acquisition of knowledge, skills, abilities and responsibility. According to the researchers, digital competence is one of the three components of digital literacy. In this study, the authors explain digital competence as a person's ability to use ICT in various areas to enhance productivity [26-28].

New technologies enable the integration of three-dimensional resources and mobilise future teachers to integrate ICT into effective teaching methods: technological, informational and educational. The researchers suggest a teacher training scheme that includes

the areas of technology, communication, education management and scientific research:

Technological competence is the ability to understand different technological choices and the correct ways to integrate them and use them within the domains and limitations of mastering tools; communication implies developing oral and written skills in physical and virtual spaces, expressing them simultaneously or at a later time with different instruments, resources, languages; the learning to incorporate ICT capabilities into various learning strategies; the ability to plan, organise, manage, control and evaluate the processes developed in pedagogical and didactic practice and in the development of institutional strategies, the possibilities of applying ICT in research processes leading to the advancement or change of knowledge [29].

Like the phenomenon of general digital competence, each of the constituent competences contains components related to motivation and responsibility. The motivational component implies the formation of a meaningful need, considers digital competence as the basis for adequate digital activities that complement human life in the modern era [30-32]. Considering the above, the digital competence, based on the continuous acquisition of competence (a system of relevant knowledge, skills, motivation and responsibility), is understood as the ability of an individual to confidently, effectively, critically and safely choose and use information and communication technologies, in various areas of life (working with content, communication, consumption, technosphere) as well as his or her readiness for such activities.

Using modern communication technologies, students can shape their social world in accordance with their projects, interests and preferences. Success in the network society requires a special type of communicative competence: the ability to manage one's own social network, to verify one's virtual "social capital" and to purposefully expand one's network of professional contacts [33-35].

The process of society's informatisation has become one of the most important global processes of modern times. This means the emergence and development of new forms of education [36]. At the same time, the constant and

rapid renewal of the education system is the need for students to independently master the skills of self-education, their active lifestyle and the ability to form independent and creative views of knowledge.

The relevance of the study is related to the new stage of digitalisation in various spheres of society, including education sector. The situation with the 2020-2021 pandemic in recent times proves that future teachers with developed digital competence are in demand in the modern job market. Future teachers can undergo great changes in implementation according to the learning environment. This training process is about preparing qualified future teachers who are capable of mobile critical thinking in students and who are prepared to competently solve educational tasks in real-life circumstances. Therefore, by taking an interactive approach in developing students' digital literacy, it contributes to the development of a future teacher's digital competencies. One of the ways to achieve such a result is to organise and shape students' digital competences (knowledge, skills and abilities) in the learning process through performing interactive tasks aimed at developing students' creative and critical thinking in online lectures and practical (seminar) assignments [37-40].

The results of the study have shown that digital competences in higher education institutions contribute to the development of a highly specialised individual. A digitally educated person has the skills of analysis, the ability to assess the credibility of any information, to understand the reliability of a source, the difference between essential and important information. In the course of the study, methods of pedagogical experimentation, questionnaires, testing, etc., were used. Quantitative and qualitative data were obtained from the resulting mathematical-statistical processing. Furthermore, the results of the study, summarised in the course of the experiment and confirmed by statistical processing data, have proved the dynamics of growth in the final results in the experimental group, the effectiveness of the theory and methodology developed and the interpretation of qualitative research in the direction of training for digital competence.

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## Conclusions

As a result of mastering the methods of digital competence education, the future specialists have not only acquired the necessary theoretical knowledge, but have also learned how to use the knowledge gained in pedagogical practice and how to apply the skills, skills of critical analysis of digital knowledge in practice. The students realised that, having mastered digital knowledge online, any digital texts constitute an ideological and value-based message in their content, and that every product of digital competence and literacy uses linguistic features and ways of encoding reality.

The future in the digital age requires a highly professional training of teaching staff. A modern student is a person living in a digital space, closely linked to digital literacy. This study focused on one of the current problems of the digital society – the scientific and methodological foundations for preparing for digital competence in higher education institutions. This means that, in line with the modern demand of the digital society to train professional future teaching staff, the authors of this study have contributed to improving the quality of human resources, the development of digital competence, and the competitiveness of the individual.

The research material is systematised by structure, the results are analysed quantitatively and qualitatively, the research work is summarised and the criteria and levels of students' assimilation of the content of digital education are determined. Based on the results of the experiential work, it is possible to train a professional specialist with developed digital competence through digital education of future pedagogical specialists and to identify priority areas for the future.

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None.

## Conflict of Interest

None.

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## Проблеми формування цифрової компетентності сучасних майбутніх учителів в умовах глобалізації

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### Анотація

**Актуальність.** У даному дослідженні розглядається одна з найважливіших проблем сучасного інформаційного суспільства - актуальність інформаційно-комунікаційних технологій, які є елементами, що зустрічаються в багатьох ситуаціях у суспільному середовищі.

**Мета.** Автори цього дослідження змогли теоретично зосередити увагу на досліджуваній цифровій компетентності в умовах глобалізації та, спираючись на праці науковців, показати можливості покращення умов підготовки майбутніх педагогічних кадрів з найважливішої науково-теоретико-методологічної точки зору.

**Методологія.** Досягти цієї реальності, доклавши зусиль до формування цифрової компетентності в умовах глобалізації та досягти очікуваних результатів, використовуючи інформаційно-комунікаційні технології (ІКТ), можна, спрямувавши роботу на прогрес.

**Результати.** Під час дистанційного навчання формуються цифрові компетентності, цифрова грамотність та рівень розвитку цифрових знань, обговорюються найкращі способи застосування цифрових навичок, демонструється актуальна інформація та навички у сфері цифрової грамотності.

**Висновки.** У наш час підхід до питання нових технологій кардинально змінюється - і реальність, і віртуальність стали єдиним цілим. Виник цифровий світ, який змінює діяльність і життя людини. У сучасному суспільстві хочеться стати користувачем віртуального простору або фахівцем, який його підтримує. Тісний взаємозв'язок між реальністю і віртуальністю надає сучасності такі риси, як гомогенність, складність, гнучкість, мобільність, швидкість, парадоксальність і невизначеність, які прийшли на зміну рівновазі і стабільності.

**Ключові слова:** глобальні технології; компетентність; цифрова компетентність; цифрова грамотність; цифрова освіта; ІКТ-компетентність; процес.