FOREIGN EXPERIENCE OF FORMING INFORMATION AND DIGITAL COMPETENCE OF FUTURE TEACHERS

Abstract. The article reviews and analyzes the foreign experience of forming the information and digital competence of future teachers. The article analyzes the Pan-European Digital Competence Framework (DigComp 2.0) and the Digital Competence Framework for Educators (DigCompEdu), which are to some extent fundamental in many European studies related to the formation of digital competencies of future professionals, including in the field of education. In particular, it is noted that DigComp 2.0 includes five competencies: information and digital literacy, communicative digital literacy, digital content creation, security in the digital environment, and problem-solving in the digital environment. While DigCompEdu contains six competencies: professional engagement, digital resources, teaching and learning, assessment, empowerment of students, and promotion (facilitation) of the development of students’ digital competence. It is also worth noting that each of the competencies is divided into sub-competencies, each of which is characterized by six levels of formation (beginner, researcher, integrator (specialist), expert, leader and pioneer) and «professional statements», which, in our opinion, will contribute to a better understanding of the phenomenon of «digital competence» and its capabilities to ensure the effectiveness of the educational process. The article considers some approaches to the definition of the term «digital competence» by foreign researchers. The article focuses on the key trends in foreign experience of forming digital competencies of future teachers. In particular, the concepts of «general digital competence» and «professionally oriented digital competence» are distinguished and it is emphasized that the latter is determined by the ability to appropriately select, plan and use information and communication technologies in professional pedagogical activities to ensure an accessible and effective educational environment. The paper also emphasizes that one of the key steps to the formation of information and
digital competence is the teacher’s understanding of its essence and importance for professional activity.

**Keywords:** information and digital competence; digital competence; future teachers; future teacher education; digital competence framework; DigComp; DigCompEdu.

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ЗАРУБІЖНИЙ ДОСВІД ФОРМУВАННЯ ІНФОРМАЦІЙНО-ЦІФРОВОЇ КОМПЕТЕНТНОСТІ МАЙБУТНІХ УЧИТЕЛІВ

**Анотація.** У статті розглянуто та проаналізовано зарубіжний досвід формування інформаційно-цифрової компетентності майбутніх учительів. Проаналізовано Загальноєвропейську рамку цифрових компетентностей (DigComp 2.0) та Рамку цифрових компетентностей освітян (DigCompEdu), які є певною мірою основоположними у багатьох європейських дослідженнях, що стосуються формування цифрових компетентностей майбутніх фахівців, зокрема і в освітній галузі. Зокрема зазначено, що DigComp 2.0 включає п’ять компетенцій: інформаційно-цифрова грамотність, комунікативна цифрова грамотність, створення цифрового контенту, безпека в цифровому середовищі та рішення проблем у цифровому середовищі. Тоді як DigCompEdu містить шість компетенцій: професійне залучення, цифрові ресурси, викладання та учіння, оцінка, розширення можливостей здобувачів, сприяння (фасилітація) розвитку цифрової компетентності здобувачів освіти. Варто також зазначити, що кожна з компетенцій поділена на підкомпетенції, кожна з яких характеризується шістьма рівнями сформованості (новачок, дослідник, інтегратор (спеціаліст), експерт, лідер та піонер) та «професійними твердженнями», що на нашу думку сприятимуть кращому розумінню освітянами феномену «цифрова компетентність» та її можливостей для забезпечення ефективності освітнього процесу. Розглянуто окремі підходи до визначення терміну «цифрова компетентність» зарубіжними дослідниками. У статті закентовано увагу на ключових тенденціях закордонного досвіду формування цифрових компетентностей майбутніх учительів. Зокрема виділено поняття «загальна цифрова компетентність» та «професійно спрямована цифрова компетентність» та наголошено на тому, що другу
визначає саме вміння доцільно добирати, планувати та використовувати інформаційно-комунікаційні технології у професійній педагогічній діяльності для забезпечення доступного та ефективного освітнього середовища. Також у праці наголошено на тому, що однією з ключових сходинок до формування інформаційно-цифрової компетентності є розуміння вчителем її сутності та важливості для професійної діяльності.

Ключові слова: інформаційно-цифрова компетентність; цифрова компетентність; майбутні учители; професійна підготовка майбутнього вчителя; рамка цифрових компетентностей; DigComp; DigCompEdu.

**Formulation of the problem.** One of the key requirements facing a modern teacher, a professional in his or her field, is the ability to adapt to the changing conditions in which the educational process has to be carried out. This is especially true for Ukrainian teachers. Forced distance or blended learning formats with unmotivated students and cameras turned off, face-to-face learning and hiding in shelters to the sound of sirens or even explosions – all this makes it difficult, and sometimes impossible, to carry out educational activities. However, despite the difficult conditions, students need to master the curriculum for the disciplines studied in a particular class. This makes teachers more and more often and effectively explore the educational space in search of the latest technologies, techniques, or individual methods and tools that will increase the level of motivation and cognitive activity of students, as well as facilitate the process of learning. One of these tools, without the use of which it is difficult to imagine a modern classroom, is information and communication technologies (ICT). Therefore, it is important to develop information and digital competence in future teachers to ensure the effective use of ICT in the educational process and to increase the level of competence of students.

**Analysis of the recent researches.** A significant number of works by foreign researchers, in particular O. Buzón-Garcia, S. Heine, M. Krepf, J. König, Á. Meling, A. Mendióroz Lacambra, M. Napal Fraile, P. de Paz-Lugo, A. Peñalva-Vélez, C. Romero-Garcia, are devoted to the study of the problem of forming the digital competence of future teachers. In the European Union, there is a digital competence framework for educators DigCompEdu developed by C. Redecker, based on the analysis of existing digital competence frameworks [6].

**The purpose of the article is** to analyze the foreign experience of forming information and digital competence of future teachers. To achieve this goal, the study outlines and solves the following tasks:
The main skill for any modern specialist is the ability to adapt to the changing conditions of today. In particular, the impact of ICTs on all spheres of life requires the formation of information and digital competence. This process should start with education, as the foundations for developing digital skills should be laid at school. However, in order to teach this to students, teachers also need to have formed information and digital competence.

Analyzing the foreign experience of forming the digital competencies of future specialists, it should be noted that in their works, researchers often rely on the European Digital Competence Framework [8].

The European Digital Competence Framework (DigComp) is a tool that defines the digital competencies required by citizens in the modern digital world. It was developed by the European Commission in cooperation with experts from different European countries.

DigComp 2.0, published in 2016, is the second version of the digital competence framework for citizens. It consists of 5 key competencies, which are divided into 21 sub-competencies. Key competencies:

- Information and digital literacy – understanding of the basic principles of digital technologies and the ability to use them to search for and process information.
- Communicative digital literacy – the ability to use digital technologies for effective communication and collaboration.
- Digital content creation – the ability to use digital technologies to create and distribute content.
- Safety in the digital environment – the ability to protect oneself and others in the digital space.
- Problem-solving in the digital environment – the ability to use digital technologies to solve problems.

Sub-competencies define the specific knowledge and skills required to master each key competency. For example, the sub-competency «Understanding the basics of digital technologies» in the key competency «Information and digital literacy» includes the following knowledge and skills:

- Knowledge of the basic principles of computers and other digital devices.
- Knowledge of basic terms and concepts in the field of information technology.
- Ability to use digital devices and software.
DigComp 2.0 is an important tool for developing citizens’ digital competencies. It is used in many European countries to develop educational programs and activities aimed at improving the digital literacy of the population [8].

In addition, in 2017, the DigCompEdu digital competence framework for educators was published. This digital competence framework is designed for educators at different levels of education, from preschool to higher education and adult education. The author of this framework is Christine Redecker. The framework describes the following components:

- Professional engagement, which includes the organization of communication with students, parents, and other stakeholders in the educational process; professional collaboration, which is communication and exchange of experience with other educators, as well as the implementation of such experience using information and communication technologies in the educational process; reflective practice, both individual and team-based, that allows educators to assess their own digital competencies; and digital continuing professional development.

- Digital resources, including the choice of digital resources to ensure the effectiveness of the educational process; creation and improvement of digital resources with regard to pedagogical goals; management, protection and sharing of digital resources, i.e. ensuring its accessibility for students and their parents, ensuring the protection of digital content and understanding the rules for its use.

- Teaching and learning. The teaching process includes planning and using ICT to enhance the educational process and increase its effectiveness, as well as developing new didactic methods and technologies. A separate component is considered here, which involves improving interaction with students during and outside the educational process, as well as the use of ICT to provide teachers with timely support and advice. It also includes collaborative learning, which aims to ensure better collaboration among students using digital technologies. The «teaching and learning» component also includes self-regulated learning, which can be fully supported through the use of ICT, i.e. services that allow you to visualize the student’s progress, plan their learning activities and reflect.

- Assessment, including assessment strategies and the use of ICT to expand their range and ensure efficiency and objectivity; data analysis, which includes the collection and processing of digital data on student performance and its communication to both students and their parents; feedback and planning, which includes providing feedback and planning further learning based on the digital data on student academic performance.
- Empowering students. One of the most important components is to ensure accessibility and inclusiveness of the educational process, which in the context of digital competencies involves taking into account the digital abilities and perceptions of students, as well as ensuring access to learning resources for all categories of students. Differentiation and individualization of learning involves the use of ICT to ensure that personal educational needs are met and that students’ individual educational trajectories are formed. And the last but not least component is the active involvement of students in the learning process, which should be ensured through the use of digital technologies.

- Promoting (facilitating) the development of students’ digital competence. Today, it is important to form information and media literacy in all participants of the educational process, so it is important for teachers to select learning tasks that would contribute to the formation of relevant skills in students. It is also necessary to introduce ICTs into the educational process to ensure effective interaction and active cooperation of students, as well as the formation of their civic competence. It is advisable to use such training sessions that would allow for creativity in the use of ICT and the creation of digital content. A prerequisite for this is the responsible use of ICTs, i.e. the creation of a safe environment for students. The use of such tasks should be aimed at developing students’ problem-solving skills, including technical ones.

It is worth noting that each of the components under consideration is characterized by six levels of formation:
- beginner (A1);
- researcher (A2);
- integrator (specialist) (B1);
- expert (B2);
- leader (C1);
- pioneer (C2).

The «pioneer» level is the highest and indicates the best development of a particular skill. In addition, each level has professional statements that fully reveal the essence of each component [6].

The considered framework of digital competencies is to some extent fundamental for research related to the formation of future teachers’ digital competencies. Thus, in the study of C. Romero-Garcia, O. Buzón-Garcia and P. de Paz-Lugo, the teacher’s digital competence is defined as the ability to use ICT in the educational process in a well-planned and methodologically sound manner, which will increase its effectiveness and the formation of digital competence in students [7].
Comparing the terms «digital literacy» and «digital competence» in the context of educational activities, G. Falloon notes that digital competence is a broader concept, as it includes not only the ability to search and select information and work with technical means, but also points out the importance of understanding the safe use of ICT and understanding its role in the educational process. This suggests that teachers should always take a deliberate approach to the choice of digital tools used in the learning process, as well as «keep up with the times» by exploring the opportunities provided by new ICT tools and implementing them in their professional activities [1].

Scientists M. Napal Fraile, A. Peñalva-Vélez and A. Mendióroz Lacambra also emphasize the need for teachers to understand the importance and feasibility of using ICT in the educational process, as well as the consequences of its use [4].

Researcher Å. Meling suggests that when considering the formation of teachers’ digital competence, we should distinguish between general digital competence and professionally oriented digital competence [3]. We agree with this opinion, as these two concepts are significantly different, because professional digital competence involves the ability to select digital resources and ICTs, as well as the ability to use them to ensure the effectiveness of the learning process and the formation of appropriate competence in students.

G. Rani and A. Gandhi, studying the digital competence of teachers, note that this competence is not only technical skills, but also cognitive, emotional and social aspects of working in a digital educational environment. This is necessary to ensure the development of students’ competencies [5].

A look at foreign experience in the formation of digital competencies reveals a wide range of approaches, strategies and innovations that can serve as a model for improving the Ukrainian system of training future teachers. For example, in the work of Å. Meling, the formation of digital competence in students of Norwegian educational institutions – future teachers is carried out during pedagogical practice, in addition, a prerequisite is the presentation of their own experience of using digital tools after practice through a presentation [3].

Scientists S. Heine, M. Krepf and J. König argue that the basis for the digitalization of educational institutions is the formed digital competence of teachers. Based on the results of the DigCompEdu study [6], the researchers suggest that the basis of this competence is the skills of working with digital resources, including their creation, improvement, management, and collaboration. Researchers consider digital resources to include multimedia data, web resources, gaming services, software and mobile applications for educational purposes, and even social networks. According to the researchers, the
formation of digital competence occurs in the process of students’ interaction with digital resources, while teachers should monitor the relevance of such resources, adapt them to the learning process, improve and use them [2]. This approach contributes to the development of professionally oriented digital competence of the teacher.

Researcher G. Falloon emphasizes the importance of applying the digital competence framework within an educational institution, as it can become the basis for further policy on the formation of digital competencies of participants in the educational process and strategies for using ICT in education and for its organization. Studying the framework by a teacher will contribute to a better understanding of the skills needed to work safely and effectively in a particular digital environment [1].

The work of M. Napal Fraile, A. Peñalva-Vélez and A. Mendióroz Lacambra notes that one of the important aspects of digital competence development is the teacher’s understanding of its essence and importance for professional activity in the modern world. Therefore, the researchers propose to introduce an element of self-assessment of the level of formation of the relevant competence in accordance with the digital competence framework and all its components for better understanding [4].

C. Romero-García, O. Buzón-García and P. de Paz-Lugo, based on the results of their own research, argue that it is important in the formation of digital competence to perform learning tasks by the student using ICT, while a prerequisite is to provide support from the teacher. However, in the course offered by the researchers, students performed tasks not only in the usual format, but also in the role of a teacher, with methodological support. This approach made it possible to increase the level of digital competence of future teachers in accordance with the criteria proposed in the digital competence framework [7].

Conclusions. Forming information and digital competence of future teachers is one of the most important tasks of modern teacher education. ICTs are an integral part of the educational process, and future teachers should be ready to use them to create an effective and accessible educational environment. The analyzed foreign experience shows that successful implementation of digital methods requires flexibility and adaptability. Given the diversity of cultures, traditions, and social contexts, teachers need to be prepared to plan, use digital tools creatively, and be ready for the changes of the information society. Understanding that there is no one-size-fits-all method allows for effective adaptation of best practices to specific contexts.

An important aspect is the focus of teaching methods on creating a stimulating environment for the development of students’ information and
digital skills. An individual approach and the use of innovative tools are becoming crucial in ensuring the effectiveness of the process of forming the necessary competencies of a modern teacher. This exchange of experience is the key to creating a high-quality and adaptive educational environment in Ukraine.

We see prospects for further research in the study of specific methods and technologies used in both domestic and foreign practice to develop the digital competencies of future mathematics teachers.

References:

Література:


