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Research paper

Formation of Digital Competence of Teachers in General Secondary Education in The Context of The Educational Hub's Activities

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Abstract

The purpose of the article is to examine the methodological features of forming digital competence among general secondary education teachers through the activities of educational hubs and to reveal the potential for using digital services in teacher training. This study addresses one of the most important issues in the modern educational process – the formation of digital competence among educators, which is viewed as a key condition for the New Ukrainian School concept and an essential skill for life in contemporary society. An analysis of scientific approaches to the interpretation of "digital competence" term is conducted.o Researchers consider a teacher's digital competence not only as a set of knowledge, skills, and abilities necessary for the effective use of information and communication technologies (ICT) in the educational process; it also encompasses the ability to integrate digital tools into the educational process, create interactive content, organize distance learning, and ensure safety in the digital environment. The results of a study of digital competence level among future general secondary education (GSE) teachers are described. The study was conducted at Nizhyn State University named after Mykola Hohol. The sample consisted of 110 students from the 1st to 4th years in the field of Education/Pedagogy. The study results confirmed the necessity and interest of students in enhancing their digital competence, leading to the establishment of an educational hub for future teachers. Scientific approaches are summarized, and a unique definition of the term "educational hub" is formulated, which is viewed as a center that unites various educational initiatives with a focus on innovation and modern teaching approaches. The main idea of such a hub is to create an environment where students, educators, and teachers can collaborate, share knowledge, and generate new ideas. The contributions of faculty within the Department of Pedagogy, Primary Education, Psychology, and Management, along with higher education students, in the activities of various educational hubs are described, highlighting lesson developments and author projects using different electronic educational resources. The results of a training program within the educational hub focused on forming digital competencies for future teachers are outlined, demonstrating its effectiveness. The program content included acquiring new knowledge and skills, mastering various digital technologies, the ability to search for, analyze, and critically evaluate information from diverse sources, and skills in creating games, presentations, interactive exercises, and mind maps. It also includes creating engaging content; developing critical thinking abilities and problem-solving skills through digital technologies, and selecting appropriate digital tools to achieve educational goals, as well as developing interactive tasks and projects.

Keywords: *Digital Competence; Educational Hub; Educational Resources; NUS Teacher.*

1. Introduction

Teachers' digital competence is one of the key conditions for successfully implementing the New Ukrainian School (NUS) concept. The Law of Ukraine's "On Education" states that information and communication competence are key competencies for a modern individual to thrive. This is due to significant changes in contemporary society influenced by technologies that have become integral to our daily lives and the educational process. Therefore, every teacher must be prepared to work in a digital environment.

Modern employers require employees to have IT skills. Consequently, teachers must prepare students to face future challenges, where the ability to work with information and technologies is critically important. Digital tools can create individualized educational trajectories for each student, enhancing learning effectiveness and meeting individual needs. At the same time, the teacher in a modern classroom becomes a source of knowledge and a mentor who helps students find and use information from various sources. To achieve this, teachers need to be confident users of digital technologies.

The COVID-19 pandemic and martial law in Ukraine highlighted the importance of digital technologies for organizing distance learning. Teachers who possess digital skills can more quickly adapt to new conditions and effectively organize the educational process. Furthermore,

digital technologies enable educators to maintain communication with students and parents through electronic journals, messengers, and other platforms, making the learning process more transparent and understandable for all participants.
Blyznyuk [3] notes that the UNESCO international program "Information for All" identifies the formation of information and digital competence in teachers as necessary, as teachers shape the information culture of children and youth.
It is worth noting that there are certain challenges for teachers. First, there is a lack of resources, as not all general secondary education institutions have sufficient technical support to integrate modern technologies into the educational process. Second, there is a need for training and support, as educators require systematic professional development to enhance their digital skills, which demands time and resources. Third, there is resistance to change, as a group of teachers may resist changes due to fear of new technologies or the habit of working with old methods.
The advantages of developed digital competence among teachers include their agility and adaptability, since digital tools allow for quick adjustments to educational materials according to class or individual student needs; improved education quality. This is determined by the fact that the use of digital resources can significantly enhance the quality of learning, making it more engaging and effective, and interactive technologies are capable of capturing students' interest and stimulating active learning and self-development.

2. Analysis of recent research and publications

Kumar and Sharma [14] emphasize that digital competence is not merely a skill set; it is a profound necessity for educators in our digitally saturated world. It demands not only technical proficiency but also the ability to navigate and critically evaluate information, essential for thriving in a knowledge-driven society. Beyond empowering educators to enrich learning experiences, it enables them to transcend limitations across multiple spheres, fostering collaboration and communication while unravelling the intricate dynamics of our digital landscape. Digital competency, according to Sharma and Sharma [22], includes a broad variety of complex skills, including cognitive, physical, social, and emotional aptitudes, that people need to successfully traverse digital environments. In 2013, a poll by Krumsvik et al. [13] included 2,524 instructors and 17,529 secondary school pupils in Norway. The results showed a strong relationship between students' academic achievement across a range of topics and their teachers' level of digital competency. This emphasizes how important it is for teachers to be digitally savvy role models for their students in terms of using ICT and learning subjects. The study highlights the necessity of giving teachers the resources they need to successfully integrate technology into their teaching practices. Also, it stresses the significance of incorporating competence development in digital skills from the beginning of future teacher education. Teachers with strong digital skills have a favorable influence on students' use of ICT in the classroom and their subject-matter learning.
Within such a landscape, the notion of innovative competence in education acquires new meaning, shifting towards digital soft skills. Digital soft skills are defined as a combination of digital skills and soft skills that are important for successful work in today's digital world. They include the ability to use digital tools and technologies in combination with communication skills, teamwork, problem solving, and adapting to change. It is not just the ability to use a computer or the Internet, but the ability to effectively apply these skills in a variety of situations, interacting with others and solving complex problems [1]. The teachers' competencies in technology, digital innovation, and creativity on curriculum changes within the context of UNESCO's Education 2030 Strategy (see Figure 1).

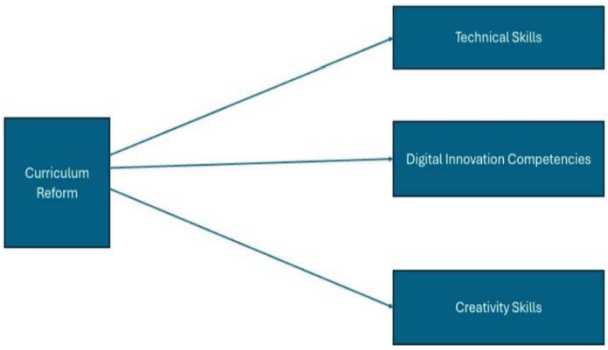

Fig. 1: Conceptual Model of UNESCO's Education 2030 Strategy [1].

To accomplish Sustainable Development Goal (SDG) 4 on Quality Education, secondary school teachers who create dynamic, adaptable learning environments must possess Teacher Digital Competence (TDC), according to a systematic review by Amilusholihah et al. [2]. The authors' findings indicate that:

1) The post-pandemic goals of the educational sector were reflected in the spike in interest in teachers' digital competency in 2024. Important research from Australia, Spain, and Switzerland has led to significant advancements in educational technology, underscoring the field's significance on a worldwide scale.
2) Targeted professional development, successful classroom technology integration, and adherence to international standards are crucial tactics for enhancing digital competency;
3) Teachers encounter obstacles, including inadequate training and institutional support, which emphasizes the necessity of organized initiatives to improve digital abilities.
4) Frameworks such as DigCompEdu, TPACK, TAM, and ISTE have demonstrated efficacy in evaluating and enhancing digital competency in instructional strategies; and (5) TDC works well to enhance student learning results..

Suzer and Koc [24] looked at the degree of digital proficiency among instructors based on several factors. Their study's objective was to ascertain teachers' digital proficiency using the European DigCompEdu framework and how it related to certain teacher and demographic traits. It was created using the quantitative research paradigm as a cross-sectional survey. 368 teachers (199 men and 169 women) employed in a large Turkish city in Central Anatolia during the 2021–2022 school year made up the sample. A questionnaire including the Digital Competencies Scale for Educators and inquiries on the demographic and professional traits of teachers - , such as age, gender, topic taught, educational background, school level, and place of employment, - was used to gather data. The results show that, on average, participating instructors have digital proficiency at the integrator (B1) level. Additionally, teachers who are male, teach scientific and math-related courses, hold a postgraduate degree, and work in urban areas have higher levels of digital competency than their peers. While teachers' digital proficiency is favorably and marginally correlated with the quantity of digital devices they own, it is not influenced by their age or

the type of school they attend. Additionally, the regression analysis identifies gender, educational background, subject, and the quantity of IT devices as important predictors, accounting for 25% of its variation.

An online questionnaire based on the digital competencies in Area 2 of the DigCompEdu framework was utilized in exploratory research by Loureiro et al. [16]. In this study, 277 instructors participated. The findings showed that although instructors appear to be comfortable utilizing technology, they still need to work on modifying digital tools to better support student learning. In addition to helping to outline future projects and guidelines in teacher training in the ARA specifically, the authors assert that global mapping of digital competencies will enable the verification of these competencies, attitudes, and abilities, as well as the integration of ICT into teaching practices.

Ramirez-Asis et al. [20] examined the digital competencies and attitudes toward the use of information and communication technologies (ICT) among secondary school teachers at the Javier Heraud Public Educational Institution in Lima, Peru, using the technology, pedagogy, and content knowledge (TPACK) model, which focuses on knowledge about technology knowledge (TK), pedagogical content, and content knowledge. This suggests that it is critical to consider these components when developing educational materials to contribute to the quality of student learning while remaining within the constraints imposed by the global health emergency. It has been demonstrated that there is a link between digital abilities and attitudes about the use of information and communication technology among instructors at a Peruvian public educational institution.

Domestic Ukrainian researchers T. Blyzniuk [3], H. Gensseruk [8], M. Kryvonos [12], N. Morze [17], O. Ovcharuk [19], I. Sereda, N. Savinova, N. Stelmach, O. Biliuk [23], and others have studied teachers' digital competence. A. Samko [21] highlighted digital competence among pedagogical staff in the postgraduate pedagogical education system.

O. Hrytsenchuk discussed international and domestic experiences in implementing digital educational hubs to support civic education [7]; L. Fedulova revealed the significance of innovative and technological hubs for regional education [6]; F. Games and M. Mayorga-Fernandez assessed the level of digital competence among rural teachers regarding ICT use [9]; S. Diaz-Trinidad and J. Moreira researched digital competence among high school teachers [10]; D. Knight analyzed the innovative activities of educational hubs [4]; Lo and Li characterized Hong Kong as an educational hub within higher education policy [15]. Technological and methodological aspects of forming digital-creative competencies among future teachers in distance education in the Republic of Kazakhstan were researched by B. Klara and T. Almas [10].

However, the issue of forming digital competence among teachers in general secondary education institutions within the framework of educational hub activities remains unresolved.

3. Method

The methodology of research included both secondary (scoping review) and primary (empirical survey) methods. The scoping review included 25 items. The sample for analysis was formed because of targeted searching within the scientometric databases ScienceDirect, MDPI, Wiley, JSTOR, and the specialized education research database ERIC. The search was conducted first by the titles and abstracts of publications, after which duplicated and relevant sources were excluded, while the relevant ones were included in the sample for further analysis.

The obtained qualitative results were triangulated by a conducted survey among 110 participants from Nizhyn State University (Ukraine). The survey form included 10 questions, of which some implied assessment with a 5-point scale and answered yes/no, and some were open questions, implying a free answer of the respondent. The results of the survey were processed using the SurveyMonkey platform.

The overall philosophical foundation of research is the interpretivist paradigm.

4. Results and discussion

The analysis of sources allowed concluding that international and Ukrainian domestic scholars interpret the definition of "digital competence" ambiguously. Researchers use various terms with similar content: information literacy, information-digital competence, information-technology competence, information culture, information-communication competence, digital competence, ICT competence, and others.

It has been established that scholars prefer the definition of "digital competence," including F.D. Guillem-Games, M.H. Mayorga-Fernandez, S. Diaz-Trinidad, J.A. Moreira, N. Morze, H. Hensseruk, and others.

In the document "Digital Competence Framework 2.0" (DigComp 2.0: The Digital Competence Framework for Citizens), digital competence is interpreted as the proficient application of information and communication technologies (ICT) in work, employment, education, leisure, and societal life, which is vital for daily socio-economic living [5].

According to the Professional Standard for Teachers [15], educators' information-digital competence includes information literacy, creating various digital educational resources, and integrating digital tools into the educational process.

Morze views digital competence as the confident and critical use of digital technologies in professional activities, everyday life, and communication [17].

These scholars believe that the digital competence of pedagogical staff is an integral part of the modern educational process and should ensure the comprehensive development of various aspects. This includes media literacy, creating and managing media content, processing and critically evaluating information data, safety and collaboration online, and knowledge about various digital technologies and devices. Also, adaptation to new technologies, using open resources and technologies for professional development, and fostering students' skills to successfully use digital technologies and services are included here.

The digital competence of a teacher in Ukraine is described across five areas: the teacher in a digital society, professional development; use of digital resources; student training and assessment; development of students' digital competences [21, p. 36].

Thus, scholars consider the digital competence of a teacher not only as a set of knowledge, skills, and abilities necessary for the effective use of information and communication technologies (ICT) in the educational process. It is not merely about the ability to use a computer but also about the capacity to integrate digital tools into the educational process, create interactive content, organize distance learning, and ensure safety in the digital environment.

In authors` view, a teacher's digital competence is a combination of knowledge, skills, and abilities that allows educators to effectively use information and communication technologies (ICT) in the educational process to enhance learning quality, which includes creating interactive materials, organizing various forms of work, and individualizing learning to expand interaction opportunities, effectively communicating with students, colleagues, and parents in an online environment, and organizing collaborative projects; for developing critical

thinking; for forming students' skills in searching, analyzing, and evaluating information in a digital environment; and for preparing students for life in a digital society, including developing digital literacy and safe online behavior skills.
Also, authors are convinced that professional development courses (regular training, seminars, and webinars, including active participation of teachers in the activities of educational digital hubs) are a significant factor in forming teachers' digital competence.
According to the Concept of the New Ukrainian School, a graduate of general secondary education must possess digital competencies, be able to work with information, think critically, and engage in innovative activities. Therefore, creating a modern, innovative information-digital learning environment is necessary to form a personality with such skills. For these reasons, the use of electronic educational resources in the educational process of higher education institutions has gained popularity, as teachers must develop students' digital competence [25].
To determine the level of digital competence among future general secondary education teachers, we conducted experimental research at Nizhyn State University named after Mykola Hohol. The sample included 110 individuals from the 1st to 4th years of the Faculty of Pedagogy, Psychology, Social Work, and Arts; the Faculty of Philology, History, and Political and Legal Sciences; and the Institute of Natural-Mathematical, Medical-Biological Sciences, and Information Technologies.
To identify the conditions for effectively planning the activities of the educational hub aimed at forming digital competence, participants were asked the following questions: https://forms.gle/czD2VyzWMELvJFmN8
These questions helped to understand the participants' current knowledge and skills and identify priority areas for developing digital competence.
Respondents indicated the following digital skills they needed for performing professional tasks: using cloud technologies; cybersecurity; remote work skills; online communication; proficiency in educational applications, resources, and web pages; creating various games and exercises; effective use of online services; and familiarity with internet resources, etc.
60% of respondents rated their level of digital skills as average, 10% as below average, and 30% as above average. Meanwhile, neither low nor high levels of self-assessment of digital skills were recorded (Figure 2).

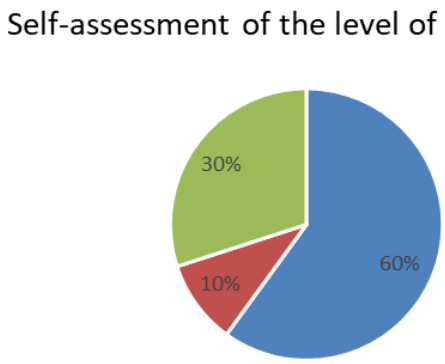

Fig. 2: Self-Assessment of Level of Digital Skills.

100% of respondents indicated the need to improve their digital skills, justifying the activities of the educational hub. When asked, "What programs, services, or tools do you use most often in your work?" the following responses were received: Google Classroom, Microsoft Teams, Zoom, Classtime, PowerPoint, educational applications, Wordwall, Live Worksheets, NaUrok, Canva, Microsoft Word, and Microsoft PowerPoint, indicating a limited diversity of mastered digital services.
100% of respondents noted that they need additional knowledge in digital resources and expressed an undeniable willingness to learn new digital tools and technologies. When asked, "What specific digital tools and technologies are you interested in?" respondents did not provide specifics, only giving responses like "Anything unknown," "Anything new and useful," "Anything for self-development," etc.
Their ability to work in a team in a digital environment and online collaboration skills were rated as sufficient for planning and organizing the educational hub's work in developing future teachers' digital competencies. Respondents did not suggest topics to include in the academic hub's training programs. Still, they highlighted elements of digital competence that may become most important in education in the coming years, namely: the ability to use online resources for learning, interactive websites, and platforms, the ability to create and use educational digital resources, mastery of modern applications for work, and services to facilitate pedagogical activities, as well as the ability to search for quality academic content.
The conducted survey proves that the functioning of an educational hub for future teachers to develop digital competencies is a crucial step for enhancing education quality and will enable:

- Adaptation to modern technologies;
- Improvement of learning quality;
- Preparation for future challenges;
- Ensuring inclusivity and accessibility;
- Providing continuous professional development.

Thus, creating such a hub will help future teachers become better prepared for the challenges of the modern world, ensure a higher quality education for students, and contribute to the overall development of Ukrainian education.
Today's access to information is becoming increasingly broad, and opportunities for self-education are limitless. This creates a need for new education formats that not only provide knowledge but also foster the development of creative and critical thinking, collaboration skills, and competencies of modern teachers by professional standards for the professions "Primary School Teacher of General Secondary Education," "Teacher of General Secondary Education," and "Primary Education Teacher" (with a junior specialist diploma), such as generating new ideas, motivating people to achieve a common goal, subject-methodological competence, information-digital competence, innovative competence, organizational competence, and the ability to learn throughout life [18].
All the above should, in authors` opinion, be the aim of the educational hub as a place where people of different ages and professions can not only deepen their knowledge and enhance their skills but also share experiences, communicate with like-minded individuals, and participate in interesting projects, webinars, forums, conferences, etc.
According to Jane Knight from the University of Toronto, "The term 'educational hub' is used by countries attempting to create a critical mass of local and international actors, including students, educational institutions, companies, knowledge industries, and scientific-

technical centers, who, by interacting thoroughly, participate in education, training, knowledge production, and innovative initiatives". She defines an educational hub as "a planned effort to build a critical mass of local and international actors strategically engaged in education, training, knowledge production, and innovation initiatives". Also, she identifies three types of educational hubs: student hubs, centers for skilled workforce training, and knowledge-innovation centers [11].

L.I. Fedulova describes an educational hub as "a new stage in the complex use of the opportunities and resources of organizations, as well as companies, to create joint products and provide services through the implementation of projects with a technological dominance". She mentions educational hubs in Ukraine, such as "Osvitoria Hub" in Kyiv, "Spalah," a network of educational hubs, "Divergent" hub in Odesa, "HUB School" in Vinnytsia, "World School Hub," a network of licensed international schools in Ukraine, the international network "Impact Hub," "Long Hub" in the village of Dovhe, Zakarpattia, the independent educational corporation "TeachHUB," "Education HUB," and others [6, p.12].

The authors of this work believe that an educational hub is not just a learning center but also a community of people striving for self-development and change. In their research, they focus on the knowledge-innovation hub, which is viewed as a center uniting various educational initiatives with an emphasis on innovation and modern approaches to learning. The main idea of such a hub is to create an environment where students, teachers, and educators can collaborate, share knowledge, and generate new ideas.

The primary tasks of the knowledge-innovation educational hub, in their opinion, are:

- Stimulating innovation in education, which involves supporting projects and initiatives aimed at implementing cutting-edge technologies and teaching methods;
- Creating conditions for sharing experiences and knowledge among representatives from different fields of education;
- Forming an innovative culture among citizens by raising awareness among educators about the importance of innovation in modern education and the training of specialists;
- Supporting projects that provide resources, consultations, and infrastructure for developing innovative ideas in education.
- In this study, the following types of activities for the knowledge-innovation educational hub were identified:
- Organizing educational events and training sessions: workshops, seminars, co-working sessions, networking events, forums, master-classes from leading specialists in the education sector, qualification enhancement courses focused on implementing innovations in the educational process;
- Creating educational programs and courses: developing modular courses on various topics, from learning foreign languages and programming to soft skills development and entrepreneurship, with an emphasis on cutting-edge technologies and practical experience;
- Supporting research and projects: co-funding and academic support for innovative research in education;
- Collaborative partnerships.

The authors convinced that these elements allow the knowledge-innovation educational hub to become a center for awakening interest in educational innovations and activating the development of modern educational practices.

The educational hub can offer courses and training that help participants master various online services and AI tools. These could include project management platforms, tools for creating engaging quality content, and resources for distance learning. Through interactive sessions and practical tasks, hub participants gain the opportunity not only to study theory but also to apply knowledge in practice.

For example, the "Digital Space for Educators" hub, created by Natalia Nahorna, a methodologist at the Small Academy of Sciences of Ukraine, unites scientists, teachers, educators, psychologists, club leaders, and others. In 2023 alone, hub participants held 24 meetings and 11 public webinars.

During the events, participants had the opportunity to familiarize themselves with digital resources and AI for summarizing and systematizing materials. They explored examples of digital developments on various topics, learned about opportunities for visualizing and structuring material, interactive exercises, and videos; received practical advice on effective testing; and learn to create digital lessons.

Specifically, the online educational forum "Developing Soft Skills in Modern School: Tools, Methodologies, Experiences," held from March 28-30, 2024, took place over three days, where participants could join training sessions, masterclasses, and workshops on the first day; on the second day, view excellent authorial developments from participants of the "Digital Space for Educators" hub and invited practitioner speakers. After the event, there was a Q&A session, discussion, and reflection. The third day featured a hackathon, during which all forum participants formed groups to create a joint lesson on developing soft skills, showcasing their team products to other participants in a joint session. More than 300 participants from various regions of Ukraine joined the forum. On the first day, there were 7 express presentations and 20 training sessions; on the second day, 40 lesson presentations and 17 simulation lessons where participants could take on the role of a student and enhance their soft skills; on the third practical day, participants from different regions, most of whom met at the forum, created 12 presentation lessons in just 1 hour and 30 minutes.

Nadia Bilousova and Inna Vozniak, teachers at Nizhyn State University named after Mykola Hohol, are also participants in the "Digital Space for Educators" online hub, having first completed training during Natalia Nahorna's authorial online course, which allowed them to join this proactive community. Thus, completing the course serves as a ticket to enter the educational online hub. The instructors participate in all nationwide webinars and forums of the hub as speakers and engage their department's teachers and students in the Primary Education program.

Within the educational hub, the laboratory for developing critical thinking at the National Center "Small Academy of Sciences of Ukraine" hosted a webinar for educators titled "Comics: Programs for Creation and Usage Features." During the session, educators learned about the use of comics in teaching the language and literature curriculum in primary schools; discussed important aspects of creating characters and storylines with a focus on the poems of H. Boyko and A. Kostetsky; became familiar with comic creation services: Comic Factory, Comic Generator, Canva, StoryboardThat, Witty Comics, Write Comics, ComicLife, Make Belief Comics; and developed a practical session titled "All About Comics" for students majoring in 013 Primary Education as an elective course on "Storytelling." Hub participants, together with instructors, practiced comic creation techniques and learned about various online resources while working on their comics.

In the framework of "Know About UA," the instructors Vozniak and Bilousova created digital projects. For instance, Vozniak's project "Unique Artists of Chernihiv Region" involved using various EOR: a presentation about artists created in the Emaze service; a quiz in Kahoot; a test "Writers of the Native Land" in Socrative; creating a puzzle "Ukrainian Girl" based on a famous painting by N. Martynenko in Jigsaw Planet; an online book about A. Kokotyukh in «Artists of Chernihiv region» (http://surl.li/uwjwlb); tasks on the board Lino (http://surl.li/dxuqvm); Google map in the service Coggle it (http://surl.li/tbvvbe).

Thanks to the training in this community and using the organization of work in the online hub "Digital Space for Educators" as an example, the faculty of the Department of Pedagogy, Primary Education, Psychology, and Management has been able to create their online hub, "Digital Lessons." The activities of this hub include:

- Conducting classes for students in the educational-professional program "Primary Education" within the framework of core academic disciplines;
- Introducing an elective course "Network Interaction in the New Ukrainian School" into the curriculum of the second (master's) level of higher education;
- Organizing professional development courses "Digital Lesson from A to Z" for primary school teachers in the Nizhyn district;
- Conducting training sessions and workshops for colleagues;
- Involving students and faculty in competitions in the categories "Education," "Methodological Development of a Lesson," etc., with ready-made digital developments (lessons);
- The department's faculty created manuals for using digital applications, including artificial intelligence.

Currently, participants in this knowledge-innovation educational hub have completed a 30-hour training program:
1-2 sessions (4 hours): Working with Flippity, Renderforest, WordItOut. 3-4 sessions (4 hours): A digital lesson as a book in Bookcreator, interactive exercises in Gamilab, emojis. 5 sessions (2 hours): Working with Mentimeter, Rebus1, and Google. Simulations. 6-7 sessions (4 hours): A digital lesson on the interactive sheet Wezer.me. 8-9 sessions (4 hours): Interactive presentation, Sway, and interactive exercises in Jigsawplanet, LearningApps. 10-12 sessions (6 hours): A digital lesson on the board Lino, working with Ourboox, Google. 13-15 sessions (6 hours): A digital lesson on the poster ThingLink, working with Coggle.it, Kahoot!
As a result of the work carried out by the educational hub, several advantages of learning in the educational hub were highlighted:

- Accessibility: Hub participants can study from anywhere in the world, making education accessible to everyone interested.
- Interactivity and flexibility: Learning in the hub takes place in an interactive format, making it engaging and captivating.
- Practical orientation: The training programs in the hub are designed considering the needs of the modern labor market.
- Development of soft skills: Learning in the hub fosters the development of important skills such as communication, teamwork, critical thinking, creativity, etc..
- Communication and networking: Hub members can meet like-minded individuals, find new friends, and partners for joint projects. The hub creates a community of like-minded people that promotes the exchange of ideas and support.
- Relevance: Training programs are constantly updated according to new trends in the field of education.

Community members can independently select topics and regulate the pace of learning, making it maximally flexible and convenient for participants.
A hub participant, I. Tokar, a student of the specialty 013 Primary Education at the first (bachelor's) level of higher education, created a digital lesson on the topic "Ukrainian Folk Tale 'Golden Shoe'" using services like Coggle.it (mind map) (http://surl.li/kmyqo); BookCreator (online book) (http://surl.li/whbfvk).
Another hub participant, L. Lytvynko, a master's level student in the specialty 013 Primary Education, created a digital lesson on the topic "Mammals and Their Features" using services such as: BookCreator, Festisite, Flippity, 3D Emoji Designer, Renderforest, Gamilab, Worditout, Google (https://youtu.be/7-GetdxA0Jg).
Here are examples of digital lessons by faculty members. The development "My Digital Lesson" by I. Voznyak on the topic "Contemporary Ukrainian Children's Writers" was created in ThinkLink as an interactive poster (http://surl.li/yfuvgf). The lesson included the use of services like Prezi, Jigsawplanet, Linoit, Wordwall, Sway, Coggle it, Ourboox.com, LearningApps, and Google.com/drawings.
The development "My Digital Lesson" by N. Bilousova on the topic "Flowering Plants" was created on the online board Lino (http://surl.li/rudroy). The development includes a survey in Quizwhizzer, an interactive presentation in Nearpod, watching videos and doing practical work on YouTube, a test in Classtime, a relaxation minute in Weavesilk, and an online board for student work in Padlet.
Thus, the educational hub is a place where everyone can find what they need for self-development and to realize their potential. The educational hub is an important tool for the development of modern educators and students. By focusing on online services, creative and critical thinking, and active participation in webinars and forums, the hub contributes to the formation of an innovative educational environment. In a rapidly changing world, such initiatives are becoming increasingly relevant and necessary. The creation of educational hubs is an important step towards modernizing the educational process and preparing the younger generation for the challenges of the 21st century.
The use of digital services is an integral part of forming teachers' digital competence within the hub's activities. Considering innovative criteria for evaluating effectiveness, we can identify several advantages of using electronic educational resources (EER):

- More opportunities for effective material assimilation;
- The ability to model various processes, replacing the use of specialized equipment and reagents;
- Interactivity;
- The possibility of network distribution;
- Convenience in information search;
- Openness to new data;
- Compact data storage.

Electronic educational resources (EER) are key in forming teachers' digital competence. They provide access to relevant information, allowing educators to use various sources to enhance their qualifications and improve teaching methods.
EER is significant in self-education; online courses, webinars, video lessons, and other resources allow teachers to independently acquire new skills and knowledge at their convenience. At the same time, teachers can interact with colleagues, exchange experiences, and ideas through forums, social networks, and other platforms.
EER helps teachers integrate technologies such as interactive boards, mobile applications, and educational platforms into the educational process.
Despite numerous advantages, the use of EER is associated with certain challenges. Firstly, there are technical limitations, as not all learners in wartime conditions have access to the necessary equipment or high-speed internet. Additionally, there are adaptation issues, as some future teachers may struggle with mastering new technologies due to a lack of necessary skills or fear of change. Meanwhile, using digital resources requires knowledge about data protection and online security. Furthermore, not all electronic resources are of high quality and may benefit learning.
To successfully implement electronic educational resources in forming future teachers' digital competence within the hub, we can suggest the following approaches:
Increasing technical literacy. Organizing training and seminars for students by experienced teachers will help them develop skills in using modern technologies.

Creating a community of practitioners and beginners will facilitate the exchange of experiences and the support of each other in mastering new technologies.
Selecting quality resources. Hub leaders should facilitate the choice and use of verified and reliable resources for learning.
Providing technical support. In case of technical problems or questions regarding the use of resources, timely assistance should be provided to participants of the educational hub.
Electronic educational resources are powerful tools for forming teachers' digital competence. Their rational use improves the educational process, making it more interactive and accessible for modern students. However, it is essential to consider possible challenges and find ways to overcome them to ensure maximum benefit from using these resources.
Table 1 presents examples of services in the hub's activities that will contribute to forming future teachers' digital competence:

Table 1: Examples of Services in the Hub's Activities

No	Online Service Title	Scope Of Application
1.	LearningApps.org	allows creating a variety of interactive exercises, promotes the differentiation of learning
2.	Coggle.it.	a diagramming and mind-mapping tool that allows structuring information, discovering connections between different concepts, and visualizing complex processes
3.	Padlet, Lino.it	virtual whiteboards that allow creating collages with various content: text, images, videos, audio recordings, etc. They can be used to organize group work, gather ideas, create presentations, and hold conferences and forums
4.	ThingLink, Genially	interactive posters allow creating a variety of interactive materials, including interactive images, presentations, infographics and games, virtual tours, dynamic presentations, and interactive tutorials on various subjects, including charts, tables, graphs, and other visual elements
5.	PurposeGames	a platform that allows users to create interactive didactic games and quizzes
6.	Blooket	a platform for creating exciting games that stimulate schoolchildren to learn
7.	Baamboozle	a service for creating games that can be used as part of lessons
8.	Study Stack	a service that allows you to create flashcards, quizzes, tests, and games
9.	Crossword Factory, Crossword generators	allows to creation of dynamic and interesting crossword puzzles, which increases student engagement.
10.	Wizer.me	An interactive worksheet that allows you to convert static PDF files to dynamic ones
11.	Ourboox, Book Creator	Services for creating electronic books
12.	Mindomo, Coogle	Services for creating mental maps
13.	Quizalize, Socrative, Kahoot	Services for creating interactive quizzes
14.	Sway, Emaze, Prezi	Services for creating dynamic and visually attractive presentations

After conducting training sessions within our hub focused on developing digital competencies, it is important to organize feedback from participants to assess the effectiveness of the event and identify areas for further improvement. Below is a list of questions posed to the participants of the educational hub: https://forms.gle/WwegxWrLe6XsMiuH6
The collected responses helped evaluate the quality of the training and better plan future activities aimed at developing digital competencies. All surveyed participants of the training cycle indicated that the training program fully met their expectations and needs, and they reported gaining new knowledge and skills that they could apply in their professional activities. Among these, participants mentioned knowledge of various digital technologies and devices, the ability to search, analyze, and critically evaluate information from different sources, skills in creating games, presentations, interactive exercises, and mind maps. They also mentioned the ability to produce engaging content; the capacity for critical thinking using digital technologies and problem-solving skills, and the ability to select appropriate digital tools to achieve educational goals and develop interactive tasks and projects.
Among the most useful aspects and topics of the training, respondents highlighted the following: a digital lesson as a book in Bookcreator, an interactive exercise in Gamilab, "Emoji," and "Digital lesson on the interactive sheet Wezer.me, "Digital lesson on the Lino board," working with Ourboox and Google services.
Participants highly appreciated the trainers' performance. They noted that the material was presented clearly and was accessible, which helped them gain confidence in applying the acquired skills in practice.
50% of respondents expressed further interest in the educational hub's activities and specified topics or digital tools they would like to study more deeply in future training sessions: a digital lesson on the ThingLink poster, working with Coggle, it and Kahoot!, services for creating didactic games like PurposeGames, Blooket, Baamboozle, and mind mapping with Mindomo and Coggle it.
To optimize and improve the hub's activities and enhance the effectiveness of the training, respondents suggested inviting specialists from various fields to create personalized learning programs for each participant, conducting master classes and workshops, and proposed adding artificial intelligence tools for lesson creation, digital services for working with students with special educational needs, image, and video creation services, etc.
In the current educational offerings of the hub, respondents highly valued the development of thinking skills; the prospect of international cooperation opportunities for subject teachers; and access to various educational tools and resources, which became an important foundation for forming the ability to select appropriate services for presenting information; skills for effectively using AI in lessons. They also mentioned effective use of services for developing students' critical thinking skills for selecting resources for restoring emotional well-being, and skills for creating non-verbal connections online.

5. Conclusion

Thus, authors can affirm the importance of the educational hub's activities for future teachers in developing digital competencies, as this contributes to:
Qualification enhancement: The educational hub provides opportunities for continuous professional development for future teachers. In a modern world where technologies are constantly changing, teachers must be able to adapt to new digital tools and methods. The hub ensures access to the most relevant knowledge and resources, allowing educators to be at the forefront of educational innovations.

Development of digital literacy: Forming digital competencies is fundamental for effective work in the context of the digital transformation of education. The educational hub helps future teachers develop skills in information and communication technologies, which are critically important for creating interactive and engaging lessons.
Innovation in education: The hub serves as a center for experimentation and the implementation of new pedagogical approaches based on digital technologies. It is a place where future teachers can learn and test innovative teaching methods that enhance the learning process and facilitate a deeper understanding of the material by students.
Support for collegial collaboration: The educational hub creates an environment for exchanging experiences and ideas among future teachers and experienced colleagues. The community formed around the hub helps educators find new solutions to their professional challenges and support each other in mastering digital tools.
Preparation for future challenges: The educational hub provides future teachers with tools and knowledge that will help them prepare students for life in a digital world. Mastery of digital competencies enables teachers to teach students critical thinking, problem-solving, and effective communication skills in a digital environment, which are essential in modern society.
Improvement of education quality: The educational hub's activities aim to make the learning process more effective, diverse, and inclusive. Teachers who have trained at the hub can create educational programs that meet various student needs, ensuring quality education regardless of their location or social status.
Thus, the activities of the educational hub are crucial for preparing future teachers to work in the modern digital world, contributing to their digital competency development and the progress of society.
Forming digital competencies among teachers is a long-term and complex process that requires collaborative efforts from teachers, higher education instructors, school administration, educational management bodies, and the state. The successful development of future teachers' digital competencies will be facilitated by their active engagement and participation in educational hubs as a new form of training for the next generation of professionals.
Authors of this study do not claim comprehensiveness in their research, as further comprehensive surveys of teachers are necessary to identify their needs for developing digital skills, create personalized training programs for each participant of the hub aimed at forming digital competencies, and organize various practitioner communities for experience sharing and regularly assess the outcomes of initiatives to enhance digital competencies.

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