



Formation of ICT Competencies of Scientific and Pedagogical Staff Under Conditions of the COVID-19 Pandemic: Innovative Technologies and Methods



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Abstract

The article is devoted to the coverage of peculiarities of innovative technologies and methods of ICT competence formation of scientific and pedagogical staff under conditions of the COVID-19 pandemic. To implement this goal, the article presents the rationale, development, and experimental testing of various innovative methods of training using ICT. To assess the effectiveness of innovative methods and information and communication technologies in the formation of ICT competence of scientific and pedagogical workers in the conditions of the COVID-19 pandemic, the article applies theoretical and empirical methods which consist in processing professional literature and in surveying scientific and pedagogical workers of COVID-19 pandemic increase their ICT competence. The following results were achieved: the confirmation that in the process of ICT competence formation a reliable result can be reached was obtained. These methods represent a set of traditional education and the latest information and communication tools and technologies, the use of which in the educational process occurs to intensify research and learning activities. The scientific novelty of the study is to demonstrate that the attitude of scientific and pedagogical staff to the use of ICT for professional development depends on access to the Internet, competence, and motivation. Working on these three factors allows for improving the ICT competence of scientific and pedagogical workers, including in Ukraine. The practical significance of the work lies in the fact that its results and conclusions can be used in pedagogical activities aimed at both training students and the professional development of specialists. As a result of the study, conclusions were made, according to the conditions of the COVID-19 pandemic the importance of distance education is increasing, requiring from the scientific and pedagogical staff a fairly high level of ICT competence, for the intensive formation of which the use of innovative technologies and methods, in particular, webinars and web quests is of great importance.

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1 Introduction

Researchers around the world are now increasingly pointing to the importance of information and communication technology (ICT) in our lives. As [Lawrence & Tar \(2018\)](#), point out, these technologies are becoming increasingly important in our daily lives and our educational system. Other researchers [Suárez-Rodríguez et al. \(2018\)](#), point out that aspects related to the integration of ICT in education, such as competence, proactive engagement, and motivation, allow advanced learners to obtain a high-quality education by applying a new way of learning through ICT. They also prove that ICT integration in education is based on the knowledge of how to communicate and integrate new trends of technological progress, and how to make higher education applicants gain new knowledge with the help of ICT. In his view, such integration is based on whole, constructivist, integrative, rational, and systemic approaches ([Baumeister et al., 2014; Singh et al., 2020](#)).

According to researchers, the integration of ICT into the educational process is extremely important for access to knowledge at the level of modern developments ([Borysenko, 2020](#)). It gives access to global resources, such as digital libraries, where higher education professors and applicants can have access to and share research and course materials anytime, anywhere, 24 hours a day, seven days a week ([Suárez-Rodríguez et al., 2018](#)). The adoption and integration of ICT in the teaching and learning environment open more opportunities for higher education researchers and applicants to perform better in the globalized digital age ([Lawrence & Tar, 2018](#)). In this regard, scholars ([Gašová et al., 2018](#)) focused on exploring the relationship between XXI century skills and digital skills and introduced a classification of digital skills for the current century, including conceptual dimensions and operational components, designed for intellectual workers. [Li et al. \(2018\)](#), found how ICTs are related to the use of technology in the education sector as a whole and conducted a study on the factors that influence the adoption and integration of ICTs in teaching and learning processes. According to [Lawrence & Tar \(2018\)](#), the adoption and integration of ICT are largely governed by characteristics of academics such as age, gender, educational experience, ICT knowledge, and attitudes. Therefore, [Eger et al. \(2018\)](#), note that a teacher with relevant knowledge and skills is better able to assess the usefulness of ICT implementation and integration in teaching and learning activities. While these knowledge skills are considered key, the digital aspect integrated with XXI century skills is still not well defined. The definition of digital skills may vary by purpose, audience, and context ([Veletsianos & Houlden, 2020](#)). But we can say that digital skills are related to the ability to search for information, the ability to use different programming languages, and the ability to interact socially and integrate new technologies ([Gašová et al., 2018](#)).

The COVID-2019 pandemic has forced educational institutions to switch to distance learning. The transition to digital pedagogy in educational institutions has necessitated an increase in digital competence ([Usca et al., 2021](#)). At the same time, studies have shown that the problems of distance education present in educational institutions for the spread of coronavirus have now been exacerbated ([Efremova, 2020](#)). For example, schools were not ready for a full transition to distance education ([Efremova, 2020](#)). The need to adapt to the constant

delivery of distance lectures and seminars and communicate with students and pupils is also a challenge for teachers (Vojtovich, 2020). Among the difficulties of distance education are:

- shortcomings in the training of scientific and pedagogical staff in digital skills, which leads to an increase in the workload of scientific and pedagogical staff and the emergence of negative emotions;
- lack of direct contact with students, the discomfort of applicants for higher education due to the inability to obtain knowledge directly from the teacher;
- lack of connection to the Internet, lack of funding, lack of preparation for the transition, lack of competence and infrastructure;
- problems of access to digital literacy for scientific and pedagogical staff.

Scientists of the world and, in particular, Ukrainian scientists, have initiated some research projects on the digitalization of education in the context of the coronavirus pandemic. However, despite the considerable interest and achievements of scientists in the study of various aspects of the problem of digitalization of education, the features and problems of the use of digital tools in higher and non-formal education systems have not yet been sufficiently investigated. This explains the purpose of this study, which is to highlight the specifics of the use of innovative technologies and methods for the formation of ICT competencies of scientific and pedagogical staff in the context of the COVID-19 pandemic (Moore et al., 2011; Hung et al., 2010). Achieving this goal required focusing on the following main objectives of the study:

- To determine the needs and peculiarities of ICT application in the professional development of scientific and pedagogical employees;
- To justify the expediency of using innovative methods with the use of ICT in the training of scientific and pedagogical workers under the conditions of the COVID-19 pandemic;
- To describe the specifics of using such innovative methods as web-quest and webinars in the training of scientific-pedagogical employees under conditions of the COVID-19 pandemic;
- To test the effectiveness of incorporating ICT courses into the training programs for scientific-pedagogical workers under COVID-19 pandemic conditions.

2 Materials and Methods

The implementation of the research goal includes justification, development, and experimental testing of various innovative methods of ICT-based learning (Voytovich 2020), which can be proposed for the formation of ICT-competence of scientific and pedagogical workers in the conditions of the COVID-19 pandemic. The study used the following methods to assess the effectiveness of innovative methods and information and communication technologies in the formation of ICT-competence of scientific and pedagogical staff in the conditions of the COVID-19 pandemic:

- theoretical (analysis of psychological and pedagogical, social and pedagogical literature, periodicals; method of theoretical generalization and systematization, generalization of research results);
- empirical (online survey; interviews to determine the level of readiness to form ICT-competence of scientific-pedagogical staff under COVID-19 pandemic; study of documentation on the organization of the educational process of the university; survey of teaching staff, statistical methods of information processing, etc.).

The surveys consisted of three parts: general information about the respondent; information about the specifics of using digital tools; information about the types and kinds of digital tools implemented in educational institutions.

3 Results and Discussions

In the process of analyzing scientific papers and practical experience of educational institutions in connection with the coronavirus pandemic, it was found that:

- The formation of ICT-competence of scientific-pedagogical employees in the context of the COVID-19 pandemic is a complex multifaceted process carried out based on the latest information and communication technologies;
- ICT competency combines the ability to master information and communication technologies and a body of knowledge in psychology, pedagogy, social pedagogy, cultural studies, and sociology, as well as the ability to disseminate new ideas and practices related to the use of ICT technologies, in particular the ability to work with different types of information, skills to work with different information sources, the ability to quickly understand and process information, adapt it to a certain age of children, and a specific purpose and tasks.

The specifics of different types of competence, in particular, the fact that:

- Communicative competence includes the ability to initiate and maintain communication, including virtual communication, with students of all ages in the implementation of quarantine measures in educational institutions; to discuss difficult topics, including issues related to the implementation of quarantine restrictions, loss of health and death of loved ones; available to speak, initiate a dialogue, creating a space of communication without restrictions.
- Productive competence includes the ability to effectively use educational innovations and ICT tools to achieve results in the formation of the higher education applicant and higher education applicants' priorities of health behaviour, motivating them to positive and consistent compliance with hygienic restrictions; to set personal goals regarding healthy lifestyles and be responsible for achieving them, be an example for the higher education applicant.
- Moral and personal competence is one of the most important components of the professional competence of scientific and pedagogical staff, indicating the formation of a system of professional and personal characteristics necessary for work aimed at the formation of knowledge, skills, abilities for healthy lifestyle skills and health conservation in conditions of pandemic coronavirus in higher education applicants and applicants for higher education.

In the course of the research, it was confirmed that a reliable result in the process of forming ICT competence can be achieved by using in the professional training of scientific and pedagogical staff innovative methods of training based on the use of ICT technologies, in particular, interactive ones (Sarfraz et al., 2015; Zaare, 2013). Such tools as webinars, web quests, etc. proved to be the most relevant during the quarantine events and transition to online teaching methods. These methods can be defined as a set of traditional education and the latest information and communication tools and technologies used in the educational process to intensify the research and learning activities of higher education applicants (van Rensburg, 2018; Bailey & Card, 2009).

The peculiarity of the webinar is that it requires the use of information and communication technologies. A webinar is a "virtual" seminar organized with the help of Internet technologies, which retains all the advantages of a traditional seminar at universities, even with the possibility of "behind the scenes" communication between "visitors" (in a separate chat room) (König et al., 2020). The webinar provides an online communication format in which all participants have the opportunity to obtain the necessary information, perform the speaker's tasks, ask their questions, or answer others' questions in an online format. Organizational aspects of preparing a webinar, such as creating registration forms for listeners, instructions for setting up audio and video communications, ensuring uninterrupted broadcast of the webinar on the appropriate platform, etc. Today there is a wide range of modern and convenient information platforms and programs that can help to optimize webinars, achieve high-quality audio, and video broadcasts, reflect the desktop speaker; provide "chat" link between the speaker and listeners, listeners among themselves; record a webinar, which allows those who could not attend, view it online (Teo, 2019; Oxman, 2008). In addition to Zoom, well-known to Ukrainian

educators, there is also a platform MyOwnConference, which allows up to 20 participants and three speakers without additional software, Freeconferencecall.com platform for online meetings, video conferences with the ability to connect up to 1000 participants, and a resource Microsoft Teams, which allows online audio, video, web conference, broadcast, and recording of large webinars for an audience of up to 10 000 participants (Maziriri et al., 2020). With a user-friendly interface, a wide range of tools for displaying everything you need during a webinar, and a simplified registration procedure, these resources allow you to show on-screen materials, and presentations and comment on them, download files and use tools to highlight important parts of the report, etc.

The use of modern ICT technologies allows the teacher to make the webinar as rich and vivid as possible (Li et al., 2018). With the help of the “Crowdcast” program, it is possible to turn webinars into interactive events, providing ample opportunities to ask questions to speakers and conduct surveys of listeners. Similar opportunities are provided by the Blackboard app, designed for interactive learning, creating learning groups, and sharing knowledge. The CenturyTech platform also provides all the necessary tools for distance learning (Sánchez-Prieto et al., 2019).

Improving the effectiveness of webinars contributes to the use of modern media technologies, which provide timely informing of the potential audience of the date and time of the webinar, increase the possibility of pre-testing all systems, ensure compliance with the rules of the event, create motivation for the listeners even before the discussion of issues, help keep motivated higher education applicants and higher education applicants from event to event (Lesyk et al., 2022). For example, you can use Google Hangouts to hold video conferences and broadcast webinars to a wide audience with the possibility of a parallel broadcast, and then produce publications on the YouTube channel. Opportunities for increased international mobility are created for academics by the online platform ClickMeeting, which works without downloading additional software, through a browser service and has a chat room with translation support in fifty-two languages while providing the ability to conduct a poll directly during the event, etc. (Ovcharuk, 2021).

Organization and conduct of webinars can be preceded by information-emotional preparation of the audience by the method of performance (other names “event communication”, “performance communication”, “scripted approach” and “event series formation”) when pedagogical content is designed and finds its expression in special events and actions that involve artificial, purposeful creation of events, winning situations that promote certain ideas in the social environment (Houlden et al., 2019). Such a measure can be conducted online and then a record of the event can be distributed. The built-in interface of many platforms and resources for visualization (icons, comics, flashcards, bookplates, memes, visual quotes) (Fernandez-Miravete & Prendes-Espinosa, 2021) that can be applied during the webinar can also be of interest to higher education applicants of innovative technologies when building ICT competencies of academic educators in the COVID-19 pandemic. The advantages of the webinar as a method of ICT-competency building for scientific and pedagogical staff under COVID-19 pandemic conditions include:

- minimal material costs for organizing and conducting this event;
- high accessibility for higher education applicants and students;
- the possibility of reaching a large audience;
- significant saving of time for the organization;
- ease of perception of information in a normal environment, without extraneous actions;
- the possibility of interactive interaction between the speaker and the listeners, as well as the listeners among themselves.

In general, webinar as a method of ICT competence formation of scientific and pedagogical staff in the COVID-19 pandemic can help to solve informationally motivating tasks, allows to provide students and students with the necessary information, etc. (Digital Competence, 2021). An equally important innovative method for building ICT competencies of academic staff in the COVID-19 pandemic is the web quest as an independent exploratory activity aimed at achieving a goal by taking an Internet route, moving sequentially from one stage to the next (Darazha et al., 2021). The methodological basis of the web quest is active learning, setting the stage for students and learners to transform new information into new knowledge that they can use (Petrenko et al., 2020).

There can be two ways to understand web quests:

- web quest as a project method, which traces the main stages of project activity: all participants are combined into several groups (research, design, literature, etc.); each group receives its tasks as well as a set of web resources to work with; each group must create a new web product (website, blog, virtual dictionary, etc.). The main focus of this type of web quest is to solve a problem/task by analyzing web resources and creating a new web product;
- web quest as a “competition”, when the host creates an interesting plot, and higher education applicants or applicants (individually or collectively, according to the plot) complete tasks (search for information, solve a mystery, etc.); all tasks are performed to achieve common goals, such as game (guess the password, find the treasure, etc.) or learning (gain new knowledge, skills). The main emphasis in this type of web quest is on finding answers through analysis of Internet sources.

The main elements to pay attention to when organizing a web quest in the process of forming ICT competencies of scientific and pedagogical workers in the COVID-19 pandemic are:

- introduction, which necessarily specifies the timing of the work and the initial situation or gives the task;
- links to Web resources that contain the material needed for the WebQuest: e-mail addresses, thematic forums, books, or tutorials from library collections;
- a step-by-step description of the task fulfilment process with an explanation of information processing principles, additional accompanying questions, cause-and-effect diagrams, tables, diagrams, charts, etc.;
- conclusions, which should contain an example of task results or their presentation, ways of further independent work on the given topic, and a branch of the practical application of results and skills.

WebQuest is implemented in stages (initial, main, and final stages). At the initial stage, higher education applicants get acquainted with the tasks and basic information about the subject of the quest, theoretical information about the subject, statistical data on it, etc. While performing the main stage the participants perform an independent search of information ([de Matos Müller & Vieira Souza, 2020](#)). In the final stage, applicants work on the formulation of conclusions to their research and distribute their developments (booklets, brochures, infographics, etc.) on popular social networks ([Ocaña-Fernández et al., 2019](#)).

The main criteria for the quality of a web quest are its originality, logicity, integrity, subordination to a certain plot, and the theme of the lesson. WebQuest becomes especially attractive to young people when there is spontaneity, non-linearity of the plot, and freedom of choice ([Goetz, 2021](#)). Summarizing the experience of research activities in higher educational institutions, we note that the proposed methods for the formation of ICT competencies of scientific and pedagogical staff in the COVID-19 pandemic can be classified according to the following features:

- by the composition and number of participants (individual web quests are designed for individual tasks; group web quests are performed by a group of universities);
- according to the degree of creativity (reproductive - webinars of theoretical content;
- creative - webinars like master classes, web-quests of scientific content search);
- according to the form of conduct (real, virtual, combined);
- by type of activity (passive, active);
- by the degree of complexity (simple, complex).

Based on this typology, criteria (motivational, cognitive, behavioural, and action) were developed to assess the effectiveness of innovative methods and information and communication technologies that can be used to form the ICT competence of scientific and pedagogical staff under the COVID-19 pandemic (Table 1).

Table 1
Criteria, indicators, and methods for assessing the level of ICT competence of scientific and pedagogical staff under the COVID-19 pandemic

Criteria	Parameters
Cognitive	Knowledge of theoretical aspects of ICTs
Motivational	Understanding the importance of ICT application in teaching/learning activities
Behavioural	ICT skills

The results of the practical application of these criteria are shown in Table 2, where B - high level, C - medium level, and H - low level.

Table 2
Comparison of ICT-competence levels of scientific and pedagogical staff before and after the experiment (given in %)

Levels	Criteria					
	Motivational		Cognitive		Behavioural	
	Before	After	Before	After	Before	After
High (B)	6.1	28.7	6.6	30.0	6.1	29.2
Average (C)	42.1	53.4	36.1	40.3	41.6	51.4
Low (H)	51.5	21.1	56.0	32.2	52.0	22.6

The results indicate certain changes in the level of ICT competencies of scientific and pedagogical staff, which occurred as a result of applying appropriate training methods: by the motivation criterion: from 51.5% at the beginning of the experiment and 21.1% at the end - low level, 42.1% and 53.4% - medium, 6.4% and 28.7% - high). Application of the Kolmogorov-Smirnov criterion ($p \leq 0.05$) revealed differences in the distributions of scientific and pedagogical employees by the levels of formation of their practical knowledge, skills, and abilities according to the identified criteria. The high effectiveness of the implemented training methods for the formation of ICT-competence of scientific and pedagogical employees under the conditions of the COVID-19 pandemic was confirmed ([Rahman et al., 2022](#)).

As a result of using innovative approaches and methods of ICT competence formation of scientific-pedagogical workers under COVID-19 pandemic conditions, the level of such competence was visibly increased. The main resources that were used for the formation of ICT-competence of scientific-pedagogical workers in the conditions of the COVID-19 pandemic were:

- special libraries in university departments;
- application of situational and dialogical teaching methods;
- application of scenario method;
- application of discussions, quests, and webinars.

Thus, the results of the experiment indicate positive changes, which is confirmed by the qualitative dynamics of the levels of ICT competencies of scientific and pedagogical employees, and their analysis allows us to assert the effectiveness of the proposed innovative ICT methods and technologies ([Kadir et al., 2021](#)). In the course of the scientific research, it was confirmed that a reliable result in the process of forming these competencies can be achieved by using innovative teaching methods based on the use of ICT technologies, primarily interactive especially relevant during quarantine events and transition to online teaching methods, in particular, such as webinars, web quests, etc., for the formation of ICT competencies of scientific-pedagogical employees in the COVID-19 pandemic conditions. The first stage of the study made the following conclusions:

- the transition to distance learning became a test for all subjects of educational activity since the COVID-19 pandemic significantly changed the conditions of educational activity and forced them to switch

primarily to a distance format (95.4%); only 4.6% of the subjects of educational activity receive contact training (Diagram 1);

- at the same time, this process has not been sufficiently resourced (especially in rural areas), also there were not created adequate conditions for the organization of the educational process in the new format; only a little more than half of the educational organizations (56%) can provide quality access to the Internet, and 44% of the participants in the educational process have access to the Internet from the home computer; meanwhile, most respondents have a permanent possibility for this (88.1%), but 11.5% not always have this possibility, and 0.4% do not have it at all. Teachers living in district centres or rural areas have more difficulties in distance learning: 59.9% are not always able to participate, 4% cannot participate at all, and only 36.1% can permanently receive educational services in a distance format;
- the amount of time devoted to the same process varies from 20 minutes per day (6%) to 60 minutes (56.8%); 37.2% of respondents spend 45 minutes a day on learning activities; and most respondents always comply with sanitary requirements (79.9%), while 18.1% do not always and 2% do not comply at all
- the distance learning format, on the one hand, became an obstacle to its effectiveness due to unequal access to online resources and digital tools, but, on the other hand, created more comfortable conditions for learning at home and saved travel time to and from the educational institution (Fernandez -Batanero, 2020). Thus, the effectiveness of distance education essentially depends on the ability of educators to self-organize their activities and motivation to perform them even under adverse conditions. The desire to increase the efficiency of educational activities and to ensure the proper quality of education encourages the participants of the educational process to master digital educational tools.

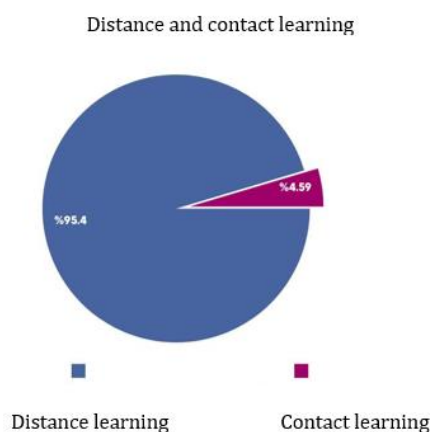


Figure 1. The ratio of distance and contact learning during the COVID-19 pandemic

The second stage of the empirical study was aimed at identifying the specifics of using digital tools in the formation of ICT competencies of scientific and pedagogical staff under conditions of the COVID-19 pandemic. Generalization of the results of the 2nd stage of the research showed that:

- the main resources using distance learning subjects are ZOOM - 97%, Skype - 76.8%, Google Classroom - 66.7%, and Microsoft Teams - 31.3%. Less frequently used are Google - 15.2%, Google Hangouts - 8.1%, Cisco WebEx - 4.1%, Canva - 5%, Quizlet - 3%, FreeConferenceCall.com - 2%, Kahoot - 2%, XMind - 1% ;
- in the process of formation of ICT competence scientific and pedagogical employees mainly use ZOOM - 93.6%, Skype - 65.3%, Google Classroom - 53.7%, Microsoft Teams - 33.7%. Less frequently used are Coggle - 15.8%, CiscoWebEx - 5.3%, Kahoot - 5.3%, Google Hangouts - 4.2%, FreeConferenceCall.com - 3.2%, Quizlet - 3.2%, Canva - 2.1%, XMind - 1.1%; the most popular social media used by teachers are Telegram and Skype, least popular are TikTok and Padlet;

- Higher education institutions help educators to master and use digital tools in educational activities through workshops - 70.3%, training - 37.8%, and webinars - 32.8%. This is combined with individual mastery of digital tools - 67.3%. Thus, scientific and pedagogical employees have an average level of mastery of digital tools and need methodological assistance and advice on the organization of work in the online format and the use of digital tools in their teaching activities. At the same time, local universities are not fully capable of meeting this need.

The third stage of the study was aimed at identifying the most methodologically effective digital tools, which, in the opinion of academic staff, should be used to build ICT competencies of academic staff under COVID-19 pandemic conditions, as well as their assessment of their level of mastery of various digital tools. Tools compared to the level at the beginning of the quarantine (Allen et al., 2020). It was found that only 1% of the research educators in the first month of the quarantine (to participate in a webinar) conducted classes online using Zoom or Skype. At the same time, video recording of lessons took 41%, a variety of digital assignments and challenges took 31%, holding meetings with students via Zoom took 27.6%; 41% of academic educators in the COVID-19 pandemic maintain social media groups to communicate with students. Based on the data obtained, the content of the webinar to improve the level of digital competence of scientific and pedagogical employees ICT competence was developed. It was structured according to the following blocks:

- Implementing digital platforms for short weekly meetings with students;
- The use of social networks for learning and communication;
- Practical recommendations on the features of digital tools of game technologies for online training.

The data of the third stage of the study indicate a significant increase in the level of ICT competence of scientific and pedagogical employees. For example, 55% of respondents estimated their level of proficiency in various digital tools compared to the level at the beginning of quarantine in March 2020 as high, 30% of respondents as medium, and 15% of respondents as low. The generalized results of the third stage of the study showed that in the conditions of quarantine restrictions scientific and pedagogical employees face the challenges, in many respects coinciding with the challenges of the whole educational system:

- insufficient access to gadgets and/or insufficient access to the Internet, as well as the insufficient level of ICT-competence of scientific and pedagogical staff;
- revision of content and forms of non-formal education in terms of distance and blended learning;
- the choice of ways to improve the ICT competencies of scientific and pedagogical staff and the resolution of key contradictions - how to prepare an adult learner for offline activities and communication with the help of digital learning tools with the help of online tools.

Generalization of the results of the third stage of the study showed that:

- Digital tools are used by scientific and pedagogical staff for a variety of scientific and pedagogical purposes: as a means of non-formal education applicants for higher education, as a means of training teachers to work with students in non-formal education, and as a means of professional development and organizational development;
- During the quarantine period the educational activities of science teachers included mainly such digital tools as a video recording of lessons, various digital tasks, and challenges, conducting meetings with children through Zoom, and groups on social networks. At the same time, there was a positive trend in the use of digital tools such as lesson-meeting with children via Zoom (45.8% in 2021 vs. 27.6% in 2020) and social media groups (45.8% in 2021 vs. 41% in 2020). Academic staff have some difficulties in using digital tools due to insufficient level of digital skills as an integral component of pedagogical competence.
- To improve the level of pedagogical competence, in particular, its components related to the use of digital skills, teaching staff have an urgent need for webinars, training, professional advice, and systematic advisory support.

4 Conclusion

Summarizing the results of our study allowed us to draw the following conclusions:

1. The pandemic has created the conditions for the rapid development of digital tools for the training and retraining of science educators. In this regard, such activities are important:
 - formation and improvement of the information and digital level of the formal education system;
 - improvement and enhancement of the content of educational programs in the system of professional training and professional development of scientific and pedagogical staff (in particular, the introduction of content modules on relevant issues of mastering virtual learning environments, their use in their professional activities, creation of digital content, etc.)
 - development of IT infrastructure of institutions, development, and implementation of high-quality e-learning tools (electronic textbooks, video content, online tests, etc.);
 - expansion of digital technology tools to form sustainable skills for solving problems of professional, educational, and everyday life;
 - the transition to distance education as a result of the COVID-19 pandemic has been a challenge for local education in all its parts and has challenged educational actors to accelerate the transition to online learning and mastering digital tools. At the same time, the subjects of educational activities noted more comfortable conditions for its implementation remotely and found didactic and methodological opportunities to organize the learning process in such a way as to maintain its effectiveness and quality of educational services.
 - the attitude of the subjects of an educational activity to open education depends on the conditions of their functioning, technical support of this process, the level of possession of digital means of professional training and professional development, the ability to self-organize their activities, and motivation for its implementation.
 - the desire to increase the efficiency of educational activity and ensure the proper quality of education encourages participants in the educational process to master digital educational tools.
 - the main digital tools used in the process of professional training and professional development in a distance learning environment are platforms such as Zoom, Skype, Google Classroom, and Microsoft Teams. These tools have already been widely used in the educational community, and academic educators have already developed some skills in using them, while digital tools such as CiscoWebEx, Kahoot, GoogleHangouts, FreeConferenceCall.com, Quizlet, Canva, and XMind are still new, and few of the academic educators have the skills to use them.
 - HEIs help students and faculty master and use digital tools in educational activities, but it is never enough because digital tools are constantly being updated.
 - Digital tools are used by academics for different educational purposes (as a means of teaching formal education and as a means of professional development and organizational development).
 - The most common tool is the Zoom platform (45.8%).
 - Scientific and pedagogical workers have positive dynamics in the assessment of their level of mastery of different digital tools compared to the level at the beginning of the quarantine. More than half (55%) significantly improved their level during the pandemic.
 - The study found that the gaps in the use of ICT tools by scientific and pedagogical workers in their professional activities depend on the level of training of educational professionals in the use of digital tools and their attitude to online learning.
2. Recommendations for professional development of scientific and pedagogical staff on the use of digital learning tools and professional development include the use of such resources:
 - web-based resources for teaching courses;
 - web-based distance learning environments in an educational institution;
 - web browsers;
 - web-based management of software resources;
 - free cloud storage for access to the institution's work materials and official documents in shared folders, such as School in the Cloud, Diary, Microsoft Office 365, and DropBox.

3. Academic educators should also pay attention to international digital learning platforms that they can use for their practice. Among them are:
 - plus.etwinning.net (<https://www.etwinning.net/en/pub/index.htm>) – a platform for educators that connects Ukrainian academic educators today;
 - schoolsonline.britishcouncil.org (<https://www.britishcouncil.org/school-resources#main-content>), a British Council website with training materials and resources for academics;
 - EPals.com (<https://www.epals.com/#/connections>), the global EPals community, a place where higher education applicants communicate;
 - knowmyworld.org (<https://knowmyworld.org>) offers teachers webinars to share their experiences;
 - www.penpalschools.com, www.leraar24.nl, www.surfspace.nl - networking platforms with European educators;
 - massive open online courses.
4. To measure the level of ICT competence, we suggest using online self-assessment tools, in particular, the Internet Cooperation Skills Barometer using cloud services, and the MENTEP TET-SAT tool (<http://mentep.eun.org>). It is important to pay attention to the Digital Competence System for Educators (DigCompEdu) and the Digital Competence System for Citizens (DigComp), which contain specific descriptors of 8 skill levels and descriptions of digital competence components.
5. We also suggest the following methods for assessing digital competence:
 - continuous assessment;
 - a team working with educational leaders and methodologists;
 - self-assessment; a team working with colleagues to assess achievement;
 - developing individualized work plans;
 - providing opportunities to observe the lessons of qualified colleagues;
 - conducting regular problem analysis, and surveys;
 - creating a portfolio (including an electronic portfolio);
 - conducting research and monitoring performance efficiency.
6. Assessment of the ICT competencies of academic staff may take the form of examinations, tests, monitoring of the learning process, etc.
7. The study shows that the attitude of academic staff towards the use of digital tools for professional development varies depending on their access to the Internet, competence, and motivation. These three factors should be paid attention to in the system of improving the ICT competence of scientific and pedagogical employees in Ukraine.
8. Further research can be aimed at a comparative analysis of European and domestic experience in the use of digital tools for distance learning of teachers and the formation of ICT competencies of scientific and pedagogical workers.
9. The use of digital tools for the assessment of ICT competencies of teachers and students requires special attention. Contemporary science needs more development of comparative-empirical research in the development of educators' ICT competencies. This can help teachers create a digital didactic environment for their subject areas, enrich their professional experience, and achieve high levels of professional development and self-confidence.
10. In general, the scientific study of the use of web quests and webinars as methods of scientific-pedagogical staff training allows to note their advantage assessment of ICT competencies of scientific-pedagogical staff can be carried out in the form of exams, testing, monitoring of the learning process, etc.
11. The study shows that the attitude of scientific and pedagogical employees to the use of digital tools for professional development varies depending on their access to the Internet, competence, and motivation. These three factors should be paid attention to in the system of improving the ICT competence of scientific and pedagogical employees in Ukraine.
12. Further research can be aimed at a comparative analysis of European and domestic experience in the use of digital tools for distance learning of teachers and the formation of ICT competencies of scientific and pedagogical workers.

13. The use of digital tools for the assessment of ICT competencies of teachers and students requires special attention. Contemporary science needs more development of comparative-empirical research in the development of educators' ICT competencies. This can help teachers create a digital didactic environment for their subject areas, enrich their professional experience, and achieve high levels of professional development and self-confidence.
14. Overall, scientific research on the use of web quests and webinars as methods of training scientific and pedagogical staff allows us to note their advantages:
 - minimum material costs for the organization and carrying out;
 - high accessibility for scientific and pedagogical workers and students;
 - significant saving of time for the organization;
 - easy perception of information;
 - possibility of remote interaction.
15. A scientific study of the use of web quests and webinars as methods of training scientific and pedagogical staff allows us to note their prospects. Each of these methods has its specifics of implementation, but common is their educational orientation: formation of cognitive (formation of theoretical knowledge about ICTs), motivational (formation of desire to use ICTs in their professional activities), and behavioural (formation of habit to work remotely) components of professional training of scientific-pedagogical workers.

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