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DEVELOPMENT OF DIGITAL COMPETENCE OF PEDAGOGICAL STAFF IN DISTANCE LEARNING BASED ON CLOUD SERVICES

Abstract. The article analyzes the experience of implementing forms and methods of development of digital competence of educators in distance education using Google Workspace for Education cloud services, based on real experience of teacher training at the university. This article discusses the concepts of competence, digital competence and distance education. The experience of the Department of Open Educational Systems and Information and Communication Technologies of the Central Institute of Postgraduate Education (Kyiv, Ukraine) in the organization of distance learning in postgraduate education is revealed, the results of research on the impact of distance technologies on the quality of education are presented. Specificity of digital competence development among pedagogical staff in the process of organizing distance education on the basis of Google Workspace for Education cloud services is determined. The article also provides an overview of the opportunities provided by digital tools and cloud services in Google Workspace for Education for distance education and highlights the effective forms and methods of developing digital competence in distance learning on the example of advanced training of university teachers. The article presents a description of effective forms of teacher training in the educational environment of Google Class, analysis of learning outcomes and identifies the benefits of joint activities of participants in the learning process. The article features the results of research on the development of teachers' digital competence measured on the basis of selected criteria for assessing the development of digital competence of research and teaching staff. The article highlights the promising trends in the development of digital competence of pedagogical staff in terms of distance education.

Keywords: digital competence; distance learning; cloud services.

1. INTRODUCTION

Problem statement. One of the most important features of our time is the transition of humanity from the industrial stage of development to the information society. In Ukraine, digitalization of education is recognized as one of the priority tasks for developing information society, which is defined in the document «Digital Agenda for Ukraine 2020» [1]. Transformation of Ukrainian society and digitalization of education, in turn, require a comprehensive analysis of new ways, methods and mechanisms for ensuring the use of digital technologies in education, and first of all, ensuring the development of digital competence of pedagogical staff during their postgraduate training. This aspect has been identified as a priority both in the Recommendations of the European Parliament and of the Council of the EU «On key competences for lifelong learning» and in a number of Ukraine's regulatory documents related to education. In the context of education reform and active development of digital technologies, a special attention is paid to the introduction of distance and blended learning on the basis of educational innovations, which are rapidly gaining popularity in all countries of the world.

Achievement of quality in education has always been the subject of special attention among scientists, taking into account its direct connection to the overall quality of life. The theory of human capital, developed at one time by T. Schultz and G. Becker [2], [3] proves the existence of a direct correlation between the level of investment in a person's education and the level of his/her well-being. Studying the effectiveness of investing in human capital, G. Becker discovered a correlation between welfare growth and the level of education, between unemployment rate and education level, between a person's age and the level of his/her education, between a person's talent and the level of his/her education, etc.

A. Migala-Warchol and M. Pasternak-Malicka [4] revealed a correlation between the level of development of science, technology and education and the indicators of socioeconomic development. According to them, investing in human skills (education) is the cheapest way both to raise the level of competitiveness of the economy and accelerate the pace of economic development, and to improve the standard of living of the population.

Taking into account the social, economic, political and spiritual significance of the quality of education, the Ministry of Education and Science of Ukraine, based on scientific research, has determined the issue of ensuring the quality of education as its priority.

Ensuring the quality of higher education, according to the recommendations of the Ministry, should be implemented according to the following main directions of work:

- compliance with European standards in the development of education;
- awareness of a new understanding of the quality assurance procedures;
- implementation of the education reform approved by the Government;
- improving the quality assurance system.

At the same time, information technologies are identified as an instrument which can guarantee quality and control for providing support for highly efficient education systems.

The issue of education informatization is in line with the government's policy regarding transferring the majority of public services into the virtual environment, «government in a smartphone», and is increasingly being addressed in a situation of the pandemic and related quarantine measures and in the context of the ability of ICT to ensure the corresponding quality of education.

The response to this issue is complex. For example, the assessment of the quality of education can be conducted according to:

- economic effect;
- communication risks (analysis of the effect of the transfer of educational communication into the virtual space; understanding of the specifics of interaction

between the participants of educational communication);
- the content of the quality assessment system and technologies of its application (what is the subject of assessment and what criteria are used for its conducting; algorithm of examination), etc.

It is well-known that distance and blended learning is an alternative to traditional face-to-face learning. In the present circumstances, more and more educational institutions are actively implementing new forms of distance and blended learning. On the basis of distance education programs and the application of innovative learning technologies, educators improve the forms and methods of joint activities of all participants who are involved in the educational process and significantly develop their digital competence. Distance learning, which most scientists understand as an individual process of transfer and acquisition of knowledge, skills and methods of human cognitive activity, makes it possible to implement all educational tasks on the basis of specialized information educational environments and distance-learning platforms through indirect interaction between participants that are distant from each other. Each educational institution is to take into account the demands of time and choose the educational environment and distance-learning platform which should meet the educational needs and demonstrate the final results of the educational process in the best way possible. Currently, one of the tasks of European and Ukraine's higher education is to create a unified educational environment in educational institutions of different types, in which pedagogical staff may have access to a unified database, regulatory and working materials, get the opportunity to improve teamwork on shared documents, exchange information, work on creating common means of visualization of educational content, etc. The main advantage of such an environment is the presentation of didactically unified and formalized educational material and the creation of favorable conditions for the use of its content, regardless of time, location and mode of students' education.

The purpose of the article is to summarize the experience of developing digital competence of pedagogical staff in the framework of postgraduate education in the conditions of distance learning on the basis of cloud services of Google Workspace for Education.

The objectives of the article are:

to review the experience of the development of digital competence of pedagogical staff during a training course in distance learning on the basis of cloud services of Google Workspace for Education;

to identify the basic technical skills that should be acquired by pedagogical staff during the training courses on the organization of distance learning on the basis of cloud services of Google Workspace for Education;

to identify the most effective forms and methods of training of pedagogical staff in the development of digital competence in the conditions of postgraduate training in distance learning on the basis of cloud services of Google Workspace for Education;

to outline prospective directions of the development of pedagogical staffs' digital competence in postgraduate distance learning.

Analysis of recent research and publications. The works of many foreign scientists, such as T. Anderson, A. Elloumi, E. Haeberle [5], [6] and others, are devoted to various aspects of distance education. In Ukraine, contemporary concepts of information society development that substantiate the socio-cultural essence of informatization and its impact on the education system are thoroughly presented in the scientific works of V. Bykov, V. Kremen, M. Kyrychenko and others [7],[8],[9].

Theoretical and practical research related to the development of digital competence of pedagogical staff has been conducted by I. Vorotnikova, N. Morze, L. Chernikova and others [10]. N. Morze and L. Chernikova consider various aspects of formation and development of digital competence of school teachers in the system of postgraduate pedagogical education.

The works of I. Vorotnikova are devoted to the problem of determining the conditions for the formation of digital competence of a teacher in the framework of postgraduate education.

Ukrainian scientists V. Bykov, V. Kukharenko, V. Oliynyk, O. Rybalko, N. Syrotenko, etc. [11],[12],[13],[14] made a significant contribution to researching theoretical and practical aspects of distance learning. Academician V. Bykov laid the foundations for the development of open education systems and the conceptual foundations of distance learning organization. V. Kukharenko's works reveal the issues related to technologies of the development of distance-learning courses, theory and practice of blended and e-learning. Academician V. Oliynyk studied topical problems of distance learning organization in the conditions of postgraduate education.

The works of scientists from the University of Educational Management V. Oliynyk, V. Gravit, V. Bykov, L. Liakhotska, O. Spirin [15][16],[17][18],[19].

are devoted to the problem of scientific support for distance education, organizational and pedagogical fundamentals of distance learning and introduction of distance learning in the practice of postgraduate education institutions.

V. Gravit and V. Oliynyk laid the theoretical foundations of distance learning in postgraduate education institutions and researched forms and methods of organizing upgrade training courses. L. Liakhotska, S. Kasian, O. Spirin study the issues of theory and practice of organization of education in the blended mode, development of digital competence of pedagogical staff according to the technology of distance learning, etc.

Current issues of the development of digital competence of pedagogical staff are addressed in the works of N. Morze O. Spirin, T. Novytska and L. Luparenko, A. Lototska and O. Pasichnyk, [20],[21],[22] and others.

Problems, tendencies and prospective ways of introduction of cloud technologies in the organization of educational and scientific systems were addressed in the works of many Ukrainian authors: S. Lytvynova, O. Spirin, L. Anikina and others [23],[24].

Foreign scholars [25] research problems of modern education and innovation in the EU countries and principles and practices of on-line education, distance education organization, etc., as well. The main requirements to the development of educators' digital competence are determined by ISTE standards, which ensure abilities for education, preparation and leadership in the digital era [26]. The ISTE standards provide a comprehensive roadmap for the effective use of technology. Researchers have developed seven standards called Learner, Leader, Citizen, Collaborator, Designer, Facilitator, and Analyst and their indicators.

Of particular importance are these guidelines for integrating standards and technology into the educational process.

Various issues related to the organization of distance learning based on Google Workspace for Education cloud services still need theoretical and experimental research, clarification of approaches, models, methods and techniques, and possible ways of implementation.

2. RESEARCH METHODS

The following set of methods was used to summarize the experience of developing teachers' digital competence in postgraduate education: theoretical analysis of the problem, diagnostic, teaching methods, primary statistical processing and generalization of the data obtained (the research results have been tested and implemented).

3. THE RESULTS AND DISCUSSION

The notion of competence is interpreted as acquired through the learning integrated ability of the individual, which consists of knowledge, experience, values and attitude that can be fully implemented in practice [25]. We agree with the definition of the notion «digital competence» formulated by V. Bykov: «digital competence of the teacher is knowledge and skills in the field of ICT and the ability to apply them in professional activities» [26].

According to the European Commission's science and knowledge service EU Science Hub, digital competence is manifested in the conscious and critical use of digital technologies by society during work, leisure time and communication [27]. L. Kartashova, N. Bakhmat, I. Plish emphasize that digital competence cannot be a permanent unit and is derived from the notion of «informatization of society», so it certainly has a dynamic nature. The authors emphasize that the digital competence of an educator presupposes his/her ability to systematically and logically use ICT, which provides access to the application and, possibly, the development of modern pedagogical technologies. That is why the digital competence of educators is perceived as the creation of information and educational electronic environment (e-environment) of the institution, which is an electronic prototype (e-prototype) of the educational institution, ensuring the accessibility and continuity of a quality education [28].

O. Dubaseniuk, N. Sydorchuk define competence as a complex integral characteristic of a personality, detailing it through the ability to solve typical problems that arise in real life situations, in various fields on the basis of applying knowledge, learning and life experience in accordance with the acquired system of values. According to scientists from the Institute for Pedagogical and Adult Education of the National Academy of Pedagogical Sciences of Ukraine, competence is the result of a person's obtainment of abilities that allow him/her to perform their work on high quality level, successfully acquire knowledge, interact with other people in different situations, quickly adapt to changes in professional activities and gain social independence [29].

We agree with the researchers' opinion regarding the understanding of competence as a result of the obtainment of abilities. Acquired competencies have the active quality of extended skills in combination with subject skills and knowledge in specific areas (situations). They are manifested in the ability to make choices according to the adequate self-assessment in a particular situation; are connected with motivation for continuous self-educational activities. The allocation of a digital competence as a separate component of professional development of an educator results from the informatization of all sectors of society, including education.

V. Bykov notes that information and communication competence means that a person has abilities to apply digital technologies in education and everyday life, to use a computer and computer tools rationally when solving tasks related to information processing, its search, systematization, storage, presentation and transmission, to build information models and study them with the help of digital technologies, to evaluate the process and the achieved results of technological activities [30]. The UNESCO ICT-CFT approach makes it possible to fully reflect the components of ICT competence during the process of acquiring them at all levels of improvement. These include understanding and realizing the role and importance of ICT for work and lifelong learning, the use of ICT tools to improve basic/subject literacy, the practice of applying ICT knowledge and skills in the ICT field for personal, social professional and educational purposes, the selection and effective use of ICT tools at different stages of the educational process [31].

Resolution No. 800 of the Cabinet of Ministers of Ukraine dated August 21, 2019 establishes the procedure, types, forms, scope (duration), frequency, conditions of qualification upgrading of pedagogical and scientific-pedagogical staff of educational institutions in Ukraine. Among the main areas of qualification upgrading, the document highlights the development of digital competence and orientation of the training of

pedagogical staff towards the use of information and digital technologies during the educational process, including e-learning, information and cyber security, etc. [32].

The experience in issues concerning scientific and methodological support for the introduction of distance learning in postgraduate education of Ukraine has been accumulated for two decades by the Department of Open Educational Systems and Information and Communication Technologies of the Central Institute of Postgraduate Education of the National Academy of Pedagogical Sciences of Ukraine. Scientists of the department S. Antoshchuk, V. Gravit, V. Bykov, S. Kasian, V. Oliynyk, L. Liakhotska, N. Gushchyna, L. Kondratova and others developed the organizational and pedagogical fundamentals of distance learning in postgraduate education, determined the requirements for qualification upgrading of senior management of educational institutions in the field of distance learning, identified the requirements for the organization of distance learning in postgraduate education, developed regulatory foundations for distance education and proposed effective technologies of qualification upgrading of pedagogical staff in the conditions of postgraduate education [7],[13],[14],[24],[26].

Currently, the experience gained by Central Institute of Postgraduate Education is successfully applied during training courses for pedagogical staff, in particular on using digital technologies in the management of educational institutions, development of innovative digital technologies and ICT tools for educators, enhancing their ability to use the newest digital tools during online learning and preparation of distance tasks, etc.

Today's distance education is in the process of active development. As the domestic experience proves, new forms of qualification upgrading of pedagogical staff in distance learning have recently appeared, the process of mastering the newest digital programs and web services during qualification upgrading in distance learning is actively spreading and the experience of introduction of digital technologies in education is being gradually formed. All forms of distance learning of scientific and pedagogical staff are oriented towards the development of a set of professional competencies, among which digital competence occupies an important place.

The Department of Open Educational Systems and Information and Communication Technologies purposefully studies the use of ICT in education and the problems of distance learning organization in educational institutions. We conducted surveys among course participants and colleagues to explore the impact of distance-learning technologies on the quality of education. These studies were conducted to assess the quality of knowledge acquired in the framework of distance learning system, to assess the main advantages and disadvantages of distance education and to identify directions for improving the use of ICT in the system of distance postgraduate education.

The results were primarily influenced by the ability of the interviewees to use ICTs in educational activities.

The survey was conducted in five regions of Ukraine: Poltava, Vinnytsia, Rivne, Zaporizhzhia regions and the city of Kyiv. Altogether 523 respondents were participating in this survey. They were employees of vocational, higher, and postgraduate education institutions, with employees of higher education institutions being the majority.

All respondents stated that they use distance learning technologies, but almost half of them constantly have problems with the technical support for this mode of education. The most common problem is the speed of the Internet and its stability.

The second problem pointed out by the respondents is the quality of educational materials available on the distance-learning platforms.

Answering the question concerning the assessment of effectiveness of the use of different technologies in distance learning, the respondents noted that the use of presentations and educational videos is highly effective, whereas the use of audio recordings is the least effective.

The survey showed that still a small number of educators use contemporary communication technologies such as educational sites and blogs, virtual boards and virtual laboratories.

For comparison, we analyzed the results of surveys of students of Baltic International Academy (Riga, Latvia) and the Institute of International and Comparative Education of Beijing Pedagogical University (Beijing, China). Surveys of students from Kharkiv, Poltava, Sumy and the parts of Donetsk and Luhansk regions controlled by Ukraine were also conducted. For analysis, we used the results of the work «Distance-learning mode of obtaining higher education: analysis of students' opinion on quality, advantages and disadvantages», published in the journal «Information Technologies and Learning Tools» No. 5 (2020).

One of the most important questions of the survey questionnaire was the question concerning the assessment of the quality of higher education obtained in the framework of in-class learning and distance-learning modes. The results of the assessment are shown in Fig. 1

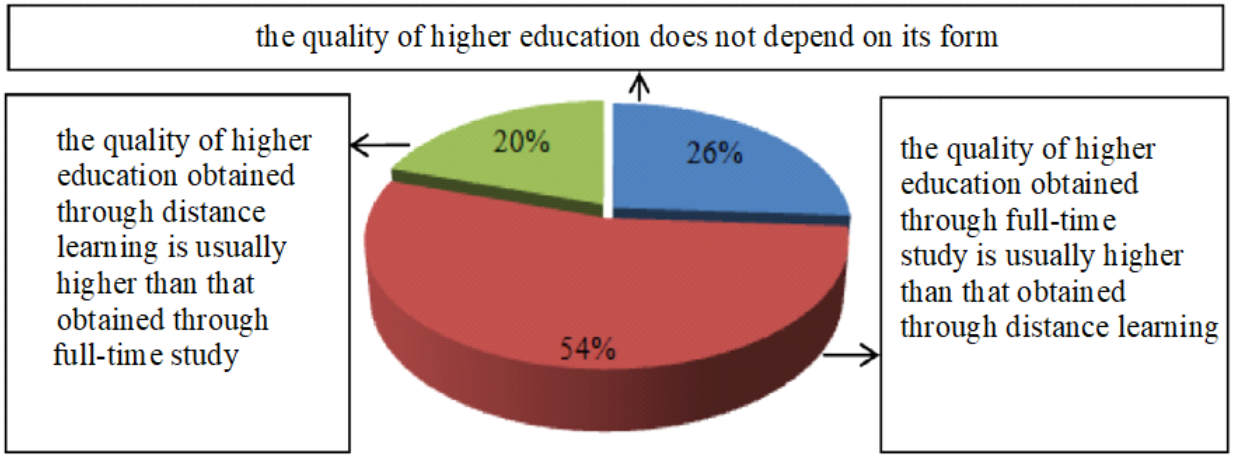

Fig. 1 Students' assessment of the quality of distance learning

This result of the survey, in our opinion, indicates the lack of stable traditions in Ukraine concerning the functioning of the distance education, as well as the lack of readiness in the society to adopt distance-learning mode at the same level as other traditional modes of learning.

At the same time, taking into account the fact that 26% of the respondents believe that the quality of higher education does not depend on the mode of its obtaining, 46% of the respondents seem to be loyal to distance education.

Among the most important reasons for the lack of popularity of distance learning among students of higher education is the lack of the culture of independent and systematic work aimed at acquiring knowledge and developing professional skills through ICT. In other words, the vast majority of students obtaining higher education need a constant support from instructors. In addition, researchers emphasize that students have low motivation to acquire professional knowledge. In in-class learning mode of education, the low level of student motivation is usually compensated by an instructor's pedagogical skills and his/her ability to constantly maintain the students' interest both towards the specific subject and obtaining a corresponding specialty.

Interesting results were obtained during a survey on attitudes towards distance education and assessment of its quality.

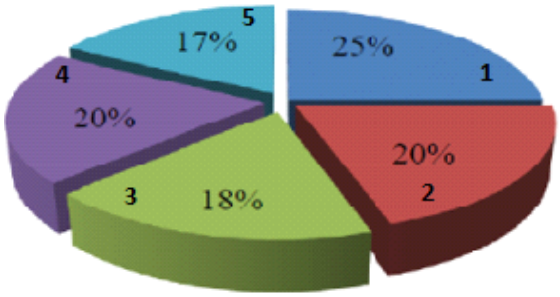

Fig. 2 The importance of the Distance Learning Advantages

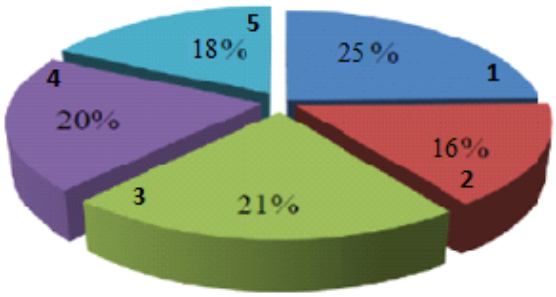

Fig. 3 The importance of the Distance Learning Disadvantages

The respondents' answers concerning the assessment of the significance of certain advantages of distance learning are shown in Fig. 2.

1 – the opportunity to learn at a comfortable pace – 25% of the respondents believe that this factor is significant;

2 – the possibility of obtaining professional knowledge in those higher education institutions, where education in frames of the traditional forms of educational communication is not available, for example, due to the cost of education or territorial remoteness of a certain higher educational institution – 20% of the respondents believe that this factor is significant;

3 - possibility to minimize the risk of professors' bias towards students - 18% of the respondents believe that this factor is significant;

4 – the possibility of mastering the curriculum at a convenient time and in a comfortable environment – 20% of the respondents believe that this factor is significant;

5 – the possibility of influencing the configuration of the curriculum within the chosen specialty (providing an individual approach) – 17% of the respondents believe that this factor is significant.

Taking into account the statistics, we can make the following conclusions:

Firstly, the biggest advantage of distance learning, according to the respondents, is the level of students' freedom in choosing the pace of learning the educational material. In other words, combining education with a job, a student often has to choose between the necessity to attend classes and the obligation to perform work assignments directly at his/her workplace.

Secondly, among the advantages of distance education, the least significant were the possibility to influence the configuration of the curriculum and students' ability to reduce the risk of bias on the part of the teacher (17% and 18% accordingly).

Thirdly, the following factors received a high level of importance among the advantages of distance learning in the respondents' assessments: the possibility to obtain higher education in those HEIs where studying in traditional forms of educational process is impossible for a particular person (high cost of education and/or considerable territorial distance from the place of residence) and the possibility to study at a convenient time.

The respondents' answers about the importance of certain disadvantages of distance learning (Figure 3) were distributed as follows (the number in the list below corresponds to the sector number of the diagram):

1 - imperfect motivation, reliance on students' self-organization and responsibility - 25% of the respondents believe that this factor is significant;

2 – imperfection of technology and methods of receiving/transmitting educational information (knowledge), as well as of procedures for evaluating learning outcomes –16% of the respondents believe that this factor is significant;

3 – limited potential of distance learning in the formation of practical skills (lack of

opportunity to provide so-called live practice) – 21% of the respondents believe that this factor is significant;

4 - impossibility to influence (correct) students' mistakes in time (duration of time between performing the task and receiving teacher's comments on its evaluation) - 20% of the respondents believe that this factor is significant;

5 - risk of incorrect identification of the student, especially when taking exams or performing current tasks - 18% of the respondents believe that this factor is significant.

Taking into account the specified information, we can make the following conclusions:

Firstly, the most noticeable, in terms of their influence, disadvantages of distance learning are positioned at the level of the student obtaining higher education (higher, individual, socio-psychological and physiological characteristics of a person and the qualitative characteristics of his/her job opportunities) – 24%, as well as at the organizational and methodological level of educational program (impossibility to correct wrong actions of a student obtaining higher education in time) – 23%. Unexpectedly low for the coordinators of the study was the result for the factor of limitations in the formation of practical skills at the level of 21%.

Secondly, imperfect technology and methodology of knowledge retransmission and the risk of wrong identification of the student have been mentioned as the least influential disadvantages of distance learning, with 15% and 17% respectively. Given the fact that these factors are related to the level of ICT development of distance learning, we can argue that they do not hinder the dynamics of distance learning.

Taking into account the practical experience of organizing the interaction between educational process participants in distance-learning and blended-learning forms on the basis of Microsoft Office 365, MobiSchool, Google Workspace for Education, we conducted a preliminary comparative analysis of technical characteristics, functionality, convenience, ease of use, financial conditions for providing educational services, which resulted in the choice in favor of Google Workspace for Education as a basic platform for research.

We assumed that the educational environment of Google Workspace for Education has many opportunities for distance learning organization, moreover, Ukrainian public educational institutions can receive access to all Google Workspace tools for free. This educational environment is a set of services from Google, through which educational institutions can conveniently organize the process of distance learning. Using digital tools, teachers can broadcast and make video calls, store an unlimited number of any files and documents, publish and check assignments, create tests, presentations, share educational materials, have discussions using online boards, etc.

In addition, the advantages of digital services of Google Workspace for Education in the organization of distance learning include: possibility of joint educational activities through digital tools, ability to effectively monitor learning, organization of interaction and information exchange, discussions in a group and chat, and also the distance learning on the basis of Google Class, online conferencing, testing, correspondence, etc. Digital services such as Google Calendar, Google Forms, Google Sheets, Google Docs, Blogger, Google sites are convenient for online learning, event planning, keeping class schedules, scientific and methodological support for the organization of scientific and methodological work of pedagogical staff, educational process management, etc.

The analysis of previous research has revealed a number of additional advantages of Google Workspace for Education compared to other cloud services, including: high quality of development that ensures stability, hacking resistance, compliance with contemporary web standards, correct display in different browsers, regular updates of cloud services, no advertising, security, constant availability, easy, simple and convenient use [33], as well as the possibility to send large attachments via e-mail, automatic storage of all drafts in one file on the disk, return to earlier versions of documents for further finalizing.

The use of the educational environment of Google Workspace for Education in distance learning gives the possibility to improve one's qualification in the use of digital tools, to develop digital competence in the field of effective joint work in Google Workspace with the help of newest learning methods. It allows all participants of the educational process to work with shared Google documents synchronously and asynchronously in editing, suggesting, and commenting modes, create shared Google slides, use shared Google sheets to gather information and generalize research, to use educational opportunities on the basis of the virtual board Google Jamboard, to store important shared learning materials for distance learning organization on shared disks. In addition, many educational opportunities are provided by Google Classroom application in terms of organizing distance learning in the educational environment of Google Workspace. Every teacher has the opportunity to create a Google Classroom, to add all colleagues or students, to publish announcements and to create educational tasks using Google Forms, shared virtual boards, to publish educational videos, materials for lectures, workshops, seminars and conferences, etc. Of great practical importance is the use of Google Meet for online meetings in distance learning, moreover, there is an opportunity of an instant joining to a video meeting on the basis of Google Meet and etc. in each Google Classroom.

The rapid introduction of distance learning in March 2020 has posed new challenges to the educational community, in particular to the staff of the University of Education Management. In order to improve the organization of distance learning, it was decided to urgently deploy a single educational environment of Google Workspace for Education on the basis of the Educational and Scientific Institute of Management and Psychology (June 2020). As a result, the experiment was technologically carried out in a short time: a new domain name for the university and corresponding user accounts were created, an application for registration was submitted to Google, corporate mail was deployed and the necessary actions were taken to administer Google Workspace for Education.

The effectiveness of the interaction between educational process participants was immediately manifested in a wide range of educational opportunities for groups created in the Google Workspace environment, among them the use of chats, discussions, use of Google Meet for online meetings, etc. (Fig.4).

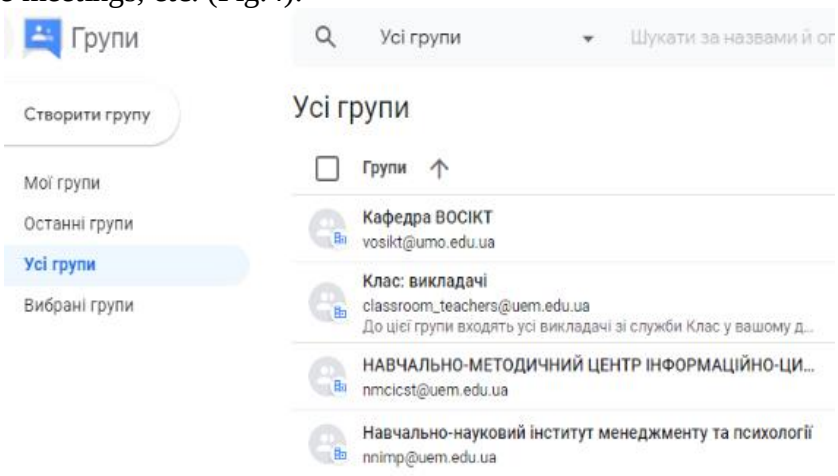

Fig. 4. Groups in Google Workspace for Education of the State Higher Educational Institution «University of Education Management» of the National Academy of Pedagogical Sciences of Ukraine

Currently, the Department of Open Educational Systems and Information and Communication Technologies of the Central Institute of Postgraduate Education provides scientific and methodological support for the experimental implementation of the educational

environment of Google Workspace for Education. In order to ensure the quality of the educational process and the development of digital competence of research and pedagogical staff of the University of Education Management, the working group of the department, consisting of the head of the department Serhii Kasian and associate professors of the department Nataliia Gushchyna and Liudmyla Kondratova, developed the Program of qualification upgrading for managerial and pedagogical personnel of educational institutions «The use of Google Workspace for Education services for the organization of distance and blended learning». When planning the course, we relied on achieving the following expected results:

1) understanding the place and role of digital technologies in the organization of distance learning;

2) the ability to organize interactive interaction during the distance learning in the environment of Google Workspace for Education;

3) knowledge of the procedure of creating a Google Class, the organization of effective interaction between teacher(s) and student(s);

4) knowledge of digital tools for conducting Google Meet video meetings and the ability to organize and conduct them;

5) mastering:

- practical skills in organizing joint work using Google Drive editors;
- knowledge and understanding of the algorithm for creating questionnaires and tests using Google Forms;
- practical skills in designing a personal site using Google tools;
- skills in transforming structural elements of in-class learning into an online format;
- application of skills in joint online activity and interaction, creation of personal online resources;

6) a value-based attitude to the process of self-improvement, lifelong learning, as well as understanding the relevance and opportunities of effective use of digital technologies.

Research and pedagogical staff was focused on improving/acquiring integrated, psychological, pedagogical, managerial, administrative and digital competencies, such as:

- ability to find new approaches to solve problems of professional activity,
- ability to make reasoned decisions and argue personal position, identify, formulate and solve problems,
- mastering the skills in independent learning and developing personal potential;
- developing the ability to apply knowledge and skills when conducting distance learning; knowledge of typical technical problems that may arise during distance learning and the algorithm for their solution; applying the acquired knowledge in practice; understanding the place of digital tools in distance learning; ability to develop new skills, technologies, didactic tools, creatively use practical experience, to organize the educational process in the information educational environment Google Workspace for Education and manage the development of digital competence of pedagogical staff.

When planning the types of educational activities, we used the approach proposed in the Recommendations for the introduction of blended learning in institutions of vocational pre-higher and higher education [23].

We transformed the usual types of classes into forms of interaction between participants of training, which can be carried out synchronously and asynchronously, and organized students' independent work.

All suggestions, offered during delivery of the course, were assigned to one of the two categories: contact hours (online) – provides for a direct interaction between learning process participants with each other and a teacher in the video meeting room of Google Meet; and online activity – provides for an indirect interaction between educational process participants

with each other and with the content in the classroom or outside it by means of online technologies of Google Class (Fig. 5).

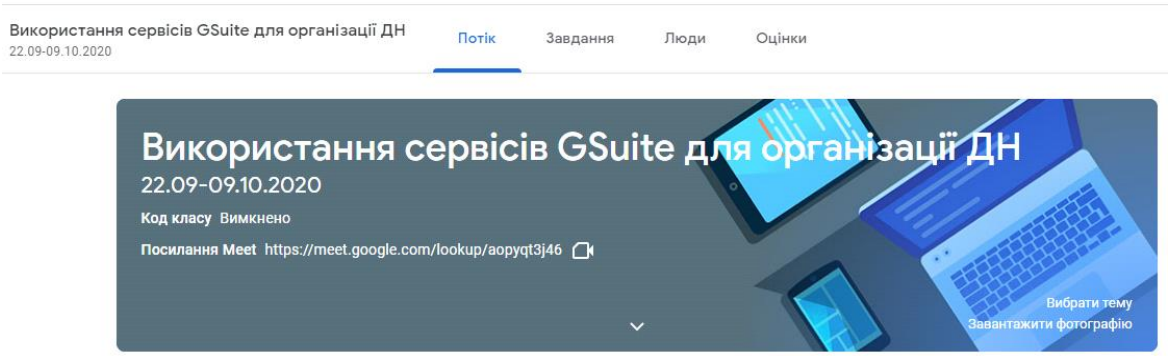

Fig. 5. Google Class of the course participants

Google Class gives the possibility to use effective forms and types of work to develop students' digital competence: different types of tasks, testing, video tutorials, chat, work on a joint document or presentation, self-assessment. Google Class provides an opportunity to give effective feedback by setting up a system of alerts, submitting work and receiving private consultation for each task.

The purpose of the practical classes was to learn the principles of functioning of the educational environment Google Workspace for Education at the university and master the digital tools of this environment in the educational process. All participants were invited to complete practical tasks in Google Class. The content of the training consisted of ten main topics of the course. During the study of the introductory topic, course participants familiarized themselves with digital technologies in the organization of distance learning, considered the place and role of digital technologies in the organization of distance learning in the conditions of a pedagogical university. During the online classes, all participants considered the possibility of organizing distance and blended learning using Google digital tools within the courses they teach to university students.

The issue of using the educational opportunities of the Google Workspace for Education for the organization of qualification upgrading training courses, master classes, training seminars, etc. was addressed specifically.

An important aspect of the course was familiarizing with the possibilities of transforming the structural elements of face-to-face classes into the online format.

In the course «Interaction during the distance learning in the environment of Google Workspace for Education», the participants were introduced to the GoogleWorkspace for Education environment, its digital tools and educational opportunities. During the online classes, all participants discussed additional learning opportunities using Google for Education, among them organization of work with shared Disks, using shared chats, interactions in groups, exchange of information, event planning using Google Calendar tools etc.

Practically oriented topics with an introduction to the environment, an overview of how to share disk files and how to work with Google Drive editors in distance learning were of great practical value.

Pedagogical staff had the opportunity to master the technology of creating questionnaires and tests using Google Forms and analyze learning outcomes using Google tools.

The course included an in-depth study of the Google Class educational environment for the organization of distance learning and the technology of creating various types of educational tasks and educational process planning.

Using the digital tools of Google Sites, each participant had the opportunity to create a

personal website and develop his/her own e-learning course in the course they teach, as well as gain practical skills in creating educational tasks of various types using Google digital tools.

The educational opportunities of digital tools for conducting online classes on the basis of the Google Meet service aroused great interest during the training.

During the final classes of the course there was a general presentation of the students' own digital products, posted on the personal website of each course participant.

In order to receive feedback, we conducted individual counseling and instructive online classes and reflections.

In order to identify the level of the development of the course participants' digital competence, we tested them at the beginning of the training and at its end. The overall educational achievements of the educational process are presented in the table of digital materials prepared by all the participants of the training.

The participants of the course demonstrated the acquired practical skills in working with Google Docs, creating interactive Google slides, organizing personal Google Sites. They gained experience in creating tests and questionnaires using Google Forms, organizing group discussions using shared Google Jamboard boards. A significant achievement of the course participants was gaining experience in conducting online meetings using Google Meet and creating and filling their own Google Classes.

During our research, in order to determine the level of the development of digital competence of each participant of the course «Using Google Workspace for Education services for organizing distance and blended learning», we developed criteria and indicators for measuring the level of the development of digital competence and identifying experience in the use of cloud services in distance learning.

Among the main criteria for assessing the digital competence, we have identified the following: motivational and value-based, cognitive-digital and activity-performance [34].

Motivational and value-based criterion is very important during the development of digital competence, as it reveals the main motives and interests of pedagogical staff in mastering the educational opportunities provided by cloud services.

In our study, the measurement of digital competence according to the motivation-value criterion allowed us to determine, both at the beginning and at the end of the experiment, the existing level of need for developing digital competence through the Google Workspace for Education cloud services for implementing distance and blended learning, as well as the current level of awareness of personal meaning and significance of digital technologies in the contemporary postgraduate educational process and the desire of the course participants to advance in the field of mastering the newest digital opportunities.

Cognitive-digital criterion provides an opportunity to measure the quality of new knowledge of digital technologies and cloud services during the educational process, awareness of their importance in pedagogical activities, and the level of knowledge about educational opportunities of Google Workspace for Education for organization of the distance and blended learning. The development of digital competence of pedagogical staff according to the cognitive-digital criterion was measured on the basis of the test tasks of the course at the beginning and at the end of the training.

The received results of the study according to the cognitive-digital criterion helped to obtain more information about the course participants, such as completeness, depth, systematic knowledge about the use of digital technologies and the level of knowledge about the features of cloud services of Google Workspace for Education.

On the basis of the *activity-performance criterion*, we recorded the level of capacity of research and pedagogical staff for independent practical skills in the use of digital technologies and cloud services during the educational process. The activity-performance component demonstrated the level of the participants' practical skills in creating their own

digital products, the level of operational practical skills in working with shared documents and the general level of readiness to work with cloud services of Google Workspace for Education during distance and blended learning.

In total, 273 people participated in the experiment. They are pedagogical and research-pedagogical staff from the State Higher Educational Institution «University of Education Management» of the National Academy of Pedagogical Sciences of Ukraine, representatives of different departments of the university. We measured the results of our study according to all selected criteria at high, sufficient and low levels. These levels of development of the digital competence of the course participants at the beginning of the study are recorded in the following diagram (Figure 6).

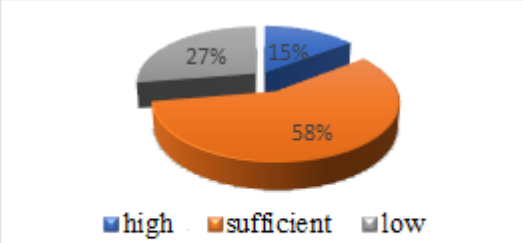

Fig. 6. Level of digital competence development of the course participants at the beginning of the studies

As a result of the experimental work, positive changes were obtained in the development of digital competence of all the participants in the course. The level of the course participants' digital competence development after the training is shown in Fig. 7.

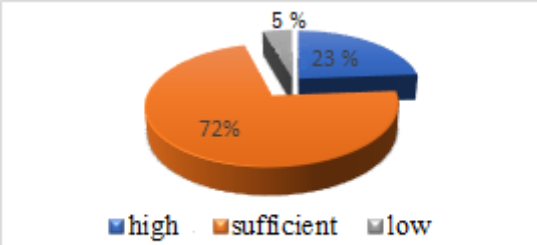

Fig. 7 Level of the course participants' digital competence development after the training

The analysis of the research data showed that as a result of the conducted work there were qualitative and quantitative changes in the indicators of levels of development of digital competence among the participants (Fig. 8).

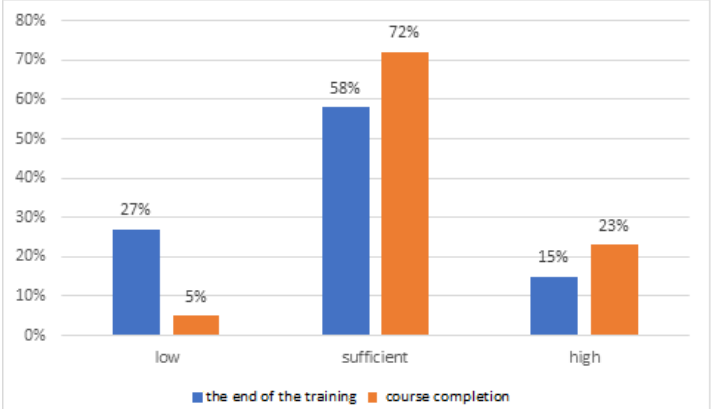

Fig. 8 Dynamics of the course participants' digital competence development

The effectiveness of the experimental work was confirmed by the summarized data of the final cross-section of the digital competence development levels of the training participants. The data showed that positive changes occurred across all criteria and levels of the development of digital competence among training participants. The low level indicator decreased by 22%. Significant differences in performance can be observed at high and medium levels. For example, the percentage of participants at the intermediate level increased by 14% and those classified as high by 8%.

The obtained analytical data testify to the correctness of the chosen strategy and tactics of research and pedagogical support for the course participants mastering educational opportunities of Google Workspace for Education cloud services during the organization of distance and blended learning in the conditions of postgraduate education.

The conducted reflection and final testing of the course participants provided an opportunity to identify the teachers' positive experience, showed the dynamics of the development of digital competence of each training participant.

Thus, if at the beginning the level of digital competence of pedagogical staff was predominantly sufficient, upon the completion of training it manifested itself at high and sufficient levels.

During the course program 273 pedagogical and scientific-pedagogical staff successfully increased their level of digital competence.

The results of the research according to the motivational and values-based criterion made it possible to identify the high level of need for the development of digital competence by means of cloud services of Google Workspace for Education for organizing distance and blended learning, to identify sufficient awareness of the personal meaning of all participants in the distance learning course.

In general, the pedagogical staff identified the importance of digital technologies in the contemporary postgraduate educational process at a high level and showed a high and sufficient level of desire for professional self-improvement in the field of mastering the newest digital opportunities by means of cloud services of Google Workspace for Education. The results of research and experimental work showed a high level of development of digital competence of participants among 17.9% of research and pedagogical staff, a middle level among 68.0% of educators and a low level among 14.1% of respondents.

The positive dynamics was especially visible with the high level of digital competence of academic staff, while the most significant positive dynamics was identified for the indicators of the low level. The statistical significance of the differences between the indicators of the control and experimental groups was determined using MS Excel Student's t-test. One of the methods of statistical hypothesis testing - correlation analysis (Student's t-test) - was used to check the accuracy of the conclusions obtained during the experiment. Taking into account the degree of volatility df=N 1 +N 2 -2=104 at p = 5% (significance level a = 0.05, which corresponds to 95% reliability), the theoretical value of Student's t-distribution is t = 1.66. The obtained coefficient t = 2.12 proved the appropriateness of the chosen forms and methods to develop educators' digital competence.

The results of the survey of training participants according to cognitive-digital criterion revealed completeness and depth of knowledge about the use of digital technologies at a sufficient level. Practical types of work helped to assess and identify a sufficient level of knowledge about the features of the use of cloud services of Google Workspace for Education in the organization of distance and blended learning.

The presentation of digital materials by all participants in the training showed their sufficient level of practical skills in creating their own digital products.

During the online sessions and individual assignments in the Google Classroom environment, the tutor-teachers also displayed a sufficient level of operational practical skills

in working with shared documents. According to the activity-performance criterion, the results of the final questionnaires of the course participants revealed a general sufficient and high level of readiness among all course participants for the organization of distance and blended learning using cloud services of Google Workspace for Education.

In general, our research and experimental work revealed the dynamics of development of digital competence, which amounted to 12.23%. The experimental work has made it possible to identify an increase in motivation among educators to use the educational environment Google Workspace for Education during the educational process, to acquire practical skills in electronic interaction of structural units of the university, to develop skills in organizing distance learning in Google Classroom.

The result of the training was the general chart of digital materials, which is presented in a Google table (Fig.9).

The obtained learning outcomes were evaluated by the supervisors-tutors of the group. All participants had an opportunity to view and comment on digital educational materials of their colleagues.

№	ПІБ учасника	Папка в Google Диску	План заняття для студентів в Google документах	Тест та таблиця з результатами анкетувань в Google Формах	Сайт-портфоліо	Google Клас	Відеозустріч в Google Meet
1		папка на диску	план заняття	тест	сайт	Клас	посилання на ві
2		папка на диску	план заняття			Googl Клас	
3		папка на диску	план заняття	Тест, таблиця	Site	Гугл класс	
4		папка	План заняття	тест, таблиця	сайт	Гугл Клас	Зустріч
5		папка на диску	план заняття	тест і таблиця	сайт	Google Клас	Зустріч
6		папка на диску	план заняття	тест	Сайт-портфоліо	Google class	таблиця
7		папка на диску	план заняття	тест,	site	Google Клас	
8		https://drive.google.c	план заняття	тест	сайт	Клас	
9		папка на диску	план заняття	тест, таблиця	Сайт-портфоліо		
10		папка на диску	план заняття	тест, таблиця	Сайт-портфоліо	Google Клас	Google Meet
11		Матеріали для заня	План занять	тест, таблиця	сайт	Google Клас	
12		папка на диску	план заняття	тест, таблиця	сайт		
13		Матеріали до занят	План-конспект	тест, таблиця	Сайт-портфоліо	Google-клас	Google-meet
14		Папка	план заняття	тест, таблиця	сайт	Google Класс	
15		Матеріали до занят	План заняття	Тест, Таблиця	Сайт-портфоліо	Google-клас	
16		Матеріали для заня	План заняття		сайт	Google-class	
17		Матеріали до занять			сайт	Гугл Клас	
18		Матеріали для заня	План заняття	Тест , Таблиця	Сайт		
19		Моя папка	Охорона довкілля		сайт	Клас	Зустріч
20		Матеріали для заня	план заняття	тест, таблиця	сайт	Клас	
21		Матеріали для заня	план заняття	тест, таблиця	Сайт	Гугл Клас	
22		Папка	план заняття	тест таблиця	сайт-портфоліо	Гугл Клас	Зустріч
23		Матеріали для заня	План заняття	Тест Таблиця	Сайт	Google Клас	

Fig. 9. General table of learning outcomes of course participants in Google Class. Screenshot

4. CONCLUSIONS AND PROSPECTS FOR FUTURE RESEARCH

According to the results of the experiment, we came to the conclusion that conducting thematic courses gives the possibility to thoroughly prepare educators in a short time to work in the educational environment of Google Workspace for Education in the conditions of distance learning and significantly increase their level of digital competence. The program of qualification upgrading of managerial and pedagogical personnel of educational institutions «Using Google Workspace for Education services for organizing distance and blended learning» brought about positive results in the preparation of university staff for the organization of distance learning in the educational environment of Google Workspace for Education. As for the quality of education during distance learning, the following main conclusions can be drawn.

The majority of education applicants, mainly for subjective reasons, have a biased attitude towards the realization of educational opportunities through distance learning. However, attention should be paid to the readiness of society and educational institutions to

accept distance education at the level of functioning autonomy and ability to ensure the quality of education.

The undoubted advantage of distance learning is the student's freedom to choose a convenient pace of learning without being tied to any specific place and time. It is obvious that the respect for the principle of freedom should be the basis not only for the use of distance learning mode, but also for the organization of interaction between the students within the so-called synchronous mode of educational communication.

Taking into account the significance of certain disadvantages of distance education, attention should be paid, on the one hand, to the need to improve the method of checking the level of acquisition of professional knowledge by students (reducing the time necessary for checking the tests by teachers and increasing the number of tests that are checked in an automatic mode), and on the other hand, to the need to constantly adjust students' motivation in view of the factors that led them to choose distance learning.

This study is at the stage of implementation, it shows a significant interest on the part of pedagogical staff in developing their digital competence in the conditions of distance learning on the basis of Google Workspace for Education services. The results of the study encourage further implementation of various forms of training for pedagogical staff, which should include the organization of qualification upgrading courses, scientific and methodological seminars, organizational meetings, individual consultations etc.

The main technical skills acquired by pedagogical staff during the training course on the organization of distance learning on the basis of cloud services of Google Workspace for Education include gaining experience in using Google editors: documents, sheets, slides. The course is designed to increase the level of practical experience in creating Google Classrooms and developing educational tasks in them, as well as to deepen technical skills in organizing video meetings based on the Google Meet service.

At the same time, there were difficulties in entering data into shared Google sheets and overcoming conflicts between personal accounts and corporate accounts of the Google Workspace for Education educational environment. Some participants of the course had minor problems with providing access to shared documents located in cloud services etc.

The conducted experimental activity allowed us to identify the work in small groups and the discussion of topical issues concerning creation of tests and questionnaires as the most effective forms of joint activity.

The most effective methods of training include methods of brainstorming and collective discussion, the method of generalization and comparison and the method of educational projects.

We identified further directions of the development of pedagogical staff's digital competence during qualification upgrading training courses in the conditions of distance learning, among which specialized courses aimed at mastering cloud services of Google Workspace for Education and Microsoft Office 365, etc. occupy an important place, as they make it possible to thoroughly prepare educators in a short time for the work in a network educational environment on the basis of the cloud-based platform Google Workspace for Education and significantly increase the level of digital competence.

In such a space, students and teachers have access to a unified database, regulatory and working materials, have the opportunity to improve teamwork on shared documents, exchange information, work on creating common means of visualization of educational content, etc.

The main advantage of such an environment is the presentation of didactically unified and formalized educational material and the creation of favorable conditions for the use of its content, regardless of time, location and mode of education.

The experimental program of qualification upgrading for managerial and pedagogical personnel in using Google Workspace for Education services for organizing distance and blended learning allowed the participants to master the basics of using digital tools of Google

Workspace for Education, to independently create a Google Class, to prepare different types of tasks, organize communication and interaction between all participants of the educational process, to provide individual consultations in distance and online modes, to transform the structural elements of the face-to-face classes into the online format.

We see the directions of further research in testing the capabilities of Google Workspace for Education for organizing distance learning and developing a methodology for deploying and using a unified digital cloud-based management system and support system for training Master's and PhD students.

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РОЗВИТОК ЦИФРОВОЇ КОМПЕТЕНТНОСТІ ПЕДАГОГІЧНИХ ПРАЦІВНИКІВ У ДИСТАНЦІЙНОМУ НАВЧАННІ НА ОСНОВІ ХМАРНИХ СЕРВІСІВ

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Анотація. У статті проаналізовано досвід упровадження форм та методів розвитку цифрової компетентності педагогічних працівників у дистанційній освіті за допомогою хмарних сервісів Google Workspace for Education на основі реального досвіду підготовки викладачів в університеті. У цій статті обговорюються поняття компетентності, цифрової компетентності та дистанційної освіти. Розкрито досвід кафедри відкритих освітніх систем та інформаційно-комунікаційних технологій в організації дистанційного навчання в післядипломній освіті, представлено результати досліджень щодо впливу дистанційних технологій на якість освіти. Визначено особливості розвитку цифрових компетентностей у педагогічних працівників під час організації дистанційної освіти на базі хмарних сервісів Google Workspace for Education. У статті також подано огляд освітніх можливостей, які надають цифрові інструменти та хмарні сервіси в Google Workspace for Education для дистанційної освіти, та висвітлено ефективні форми та методи розвитку цифрової компетентності під час дистанційного навчання на прикладі підвищення кваліфікації викладачів університету. Стаття містить опис досвіду роботи кафедри відкритих освітніх систем та інформаційно-комунікаційних технологій Інституту післядипломної освіти. У статті представлено опис ефективних форм підготовки вчителів в освітньому середовищі Google Class, аналіз результатів навчання та визначено переваги спільної діяльності учасників навчального процесу. У статті представлені результати дослідження розвитку цифрової компетентності викладачів у післядипломній дистанційній формі навчання на основі хмарних сервісів Google Workspace for Education, виміряні на основі обраних критеріїв оцінки розвитку цифрової компетентності сучасних науково-педагогічних працівників. У статті висвітлено перспективні тенденції розвитку цифрової компетентності педагогічних працівників з точки зору дистанційної освіти.

Ключові слова: цифрова компетентність; дистанційне навчання; хмарні сервіси.

РАЗВИТИЕ ЦИФРОВОЙ КОМПЕТЕНТНОСТИ ПЕДАГОГИЧЕСКИХ РАБОТНИКОВ В ДИСТАНЦИОННОМ ОБУЧЕНИИ НА ОСНОВЕ ОБЛАЧНЫХ СЕРВИСОВ

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Аннотация. В статье проанализирован опыт внедрения форм и методов развития цифровой компетентности педагогических работников в дистанционном образовании с помощью облачных сервисов Google Workspace for Education на основе реального опыта подготовки преподавателей в университете. В этой статье обсуждаются понятия компетентности, цифровой компетентности и дистанционного образования. Раскрыто опыт кафедры открытых образовательных систем и информационно-коммуникационных технологий в организации дистанционного обучения в последипломном образовании, представлены результаты исследований влияния дистанционных технологий на качество образования. Определены особенности развития цифровых компетентностей среди педагогических работников в процессе организации дистанционного образования на базе облачных сервисов Google Workspace for Education. В статье также представлен обзор образовательных возможностей, которые предоставляют цифровые инструменты и облачные сервисы в Google Workspace for Education для дистанционного образования, и освещены эффективные формы и методы развития цифровой компетентности во время дистанционного обучения на примере повышения квалификации преподавателей университета. Статья содержит описание опыта работы кафедры открытых образовательных систем и информационно-коммуникационных технологий Института последипломного образования. В статье представлено описание эффективных форм подготовки учителей в образовательной среде GoogleClass, анализ результатов обучения и определены преимущества совместной деятельности участников учебного процесса. В статье представлены результаты исследования развития цифровой компетентности преподавателей в последипломном дистанционной форме обучения на основе облачных сервисов Google Workspace for Education, измеренные на основе выбранных критериев оценки развития цифровой компетентности современных научно-педагогических работников. В статье освещены перспективные тенденции развития цифровой компетентности педагогических работников с точки зрения дистанционного образования.

Ключевые слова: цифровая компетентность; дистанционное обучение; облачные сервисы.