Organization of Educational Space Using Cloud Computing in the Professional Training of Specialists

Andrii Shuliak[1], Andrii Hedzyk[2], Nina Tverezovska[3], Lyubov Fenchak[4], Natalia Lalak[5], Anatolii Ratsul[6], Oleksandr Kuchai[7]

[1] PhD in Education, Teacher of Department of informatics, Information and Communication Technology, Pavlo Tychyna Uman State Pedagogical University, Ukraine

[2] Postgraduate student (PhD), National Pedagogical Dragomanov University, Ukraine

[3] Doctor of Pedagogical Sciences, Professor, Professor of Social Work and Rehabilitation Department, National University of Life and Environmental Sciences of Ukraine, Ukraine

[4] Candidate of Pedagogical Sciences, Associate Professor, Mukachevo State University, Ukraine

[5] Candidate of Pedagogical Sciences, Associate Professor, Mukachevo State University, Ukraine

[6] Doctor of Pedagogical Sciences, Professor, Head of the Department of Pedagogy and Special Education, Volodymyr Vynnychenko Central Ukrainian State Pedagogical University, Ukraine

[7] Doctor of Pedagogical Sciences, Associate Professor, Professor of Pedagogy Department, National University of Life and Environmental Sciences of Ukraine, Ukraine

Summary

The possibilities of organizing the educational space by means of cloud computing in the professional activities of specialists are clarified. The content of the concept of "cloud computing" is presented. A list of services offered by cloud technologies is provided. The advantages of these technologies are shown: do not need powerful computers, which reduces the price of a PC, increase the power of a PC due to servers, reduce the cost of purchasing software (programs in the cloud), the inexpediency of constant updates, since everything is located in the cloud, the absence of piracy, unlimited amount of stored data, availability from different devices and from different places, data resistance to loss, performing many types of educational work, monitoring and evaluating online; saving money on paying technical specialists; saving disk space; openness of the educational environment. The disadvantages of their use are outlined. Examples of using cloud computing in education are demonstrated. Independent user activity is considered as one of the most accessible and reliable ways to improve the effectiveness of training and activate the educational process. Cloud computing, characterized by simplicity of distribution and updating, deliver didactic materials in the most reliable and economical way. Attention is focused on the possibilities of implementing cloud computing in the educational process. The forms of using cloud technologies in education, the necessary components for applying cloud computing, and the types of activities supported in the cloud are outlined. The structural elements of an educational institution as a cloud object are analyzed.

Keywords:

cloud computing, professional activity, specialists, education, organization of educational space, higher education institutions, independent user activity.

1. Introduction

The society has entered an important period of its development – the era of informatization. The use of electronic computers has moved to the sphere of direct production. To solve theoretical and practical problems that arise during human activity in various fields of science, technology and production in order to free a person from excessive intellectual load, the use of computer technology has a great effect, if there is sufficient software and its effective use. Students and pupils are increasingly using mobile phones, tablets and other gadgets, the main purpose of which for this category of the population today is entertainment and games, although the possibilities in use are much wider. That is why teachers of general secondary and higher education are faced with the task of providing the educational process with high – quality electronic learning tools, but not only for computers, but also for other modern devices that could be used for the educational process both in general education and higher educational institutions (CEI and universities, respectively), and being in any other place, whether in places of public meetings or at home. As a result, one of the most pressing issues remains the use of Internet resources in the educational process of higher education institutions and universities. And such new technologies as virtual, web, and cloud computing help to change the learning environment, as well as make education (whether higher or secondary) more accessible [18]

The current stage of development of society is characterized by deep economic and social transformations

Manuscript received September 5, 2022
Manuscript revised September 20, 2022
https://doi.org/10.22937/IJCSNS.2022.22.9.58

based on the widespread use of scientific and technological progress in all spheres of human activity. One of the most important factors for accelerating scientific and technological progress, automating and intensifying production, creating new highly efficient technologies, improving planning and management is the widespread use of cloud computing. The use of cloud computing in the field of education opens up great opportunities for creativity of teachers and pupils, professors and students, expands the range of solutions to professional and research tasks, and at the same time puts forward qualitatively new requirements for training specialists, their readiness to use cloud technologies in professional activities.

Now, internet technologies have become accessible to all segments of the population and occupy an important place in almost all branches of public activity, in particular in education. The characteristics of modern hardware change and improve almost daily, any educational institution is unlikely to be able to update its technical base in accordance with the computing resources of modern computers and fill the educational process with the latest innovations in computer technology. The same situation applies to software, which implies considerable material costs for maintaining information services for students. According to the experience of developed countries, a successful solution to these problems is the introduction of "cloud computing" into the educational process.

The purpose of the article: to find out the possibilities of organizing the educational space by means of cloud computing in the professional activities of specialists.

2. Analysis of recent research and publications

V. Kosik, M. Tropina analyzed the features of implementing cloud computing, in particular computer-aided design systems in the educational environment of an educational institution as a key driver of digital transformation of Education; highlighted the potential of implementing cloud technologies in the educational process, determined their impact on the learning component; analyzed and evaluated the experience of using individual services and components of the cloud environment in the process of training future pedagogical staff in educational institutions [7].

Kotiash, I., Shevchuk, I., Borysonok, M., Matviienko, I., Popov, M., Terekhov, V., Kuchai O. express that the use of multimedia technologies in the educational process of higher education institutions allows to move from a passive to an active way of implementing educational activities, in which the student becomes the main participant in the learning process. Multimedia technologies must meet the goals and objectives of the course and be an integral part of the learning process. [8].

A. Karabin, B. Krishchuk reveal the issues of modernization of professional training of future specialists by means of cloud computing, as a strategic scientific and professional reference point in the field of Teacher Education [6].

A. Voznyuk, T. Lekhitsky analyzed the influence of modern teaching tools using cloud computing on the formation of professional culture of future specialists in higher education institutions [19].

Shunkov, V., Shevtsova, O., Koval, V., Grygorenko, T., Yefymenko, L., Smolianko, Y., Kuchai, O. study the effectiveness of the use of network and multimedia technologies in the training of future teachers depends on the level of conceptual development of pedagogical tools used in the organization of educational and cognitive activities of students; from the degree of adaptability of the educational and information environment of training a modern specialist to his professional environment; from the level of readiness of students to perform professionally-oriented tasks with the help of network and multimedia technologies. [16].

V. Oleksiuk suggests the process of deploying the information educational environment of secondary and higher education institutions using Google services [13].

M. Shishkina considers cloud computing as advanced technologies of the Information Society, playing the role of a leading tool for informatization of Higher Education [15].

Kuchai, O., Skyba, K., Demchenko, A., Savchenko, N, Necheporuk, Y., & Rezvan, O. examine the role of multimedia education in the development of the information society. The information range is skilled both as a separate sector of the economy and as a factor in the modernization of education [10].

J. Zaporozhchenko considers the goal of education to be to prepare students for full-fledged and effective participation in professional activities in the information society [22].

V. Bykov sees cloud computing as one of the most attractive for teachers [2].

3. Research methods

To solve research problems, a set of mutually complementary methods was used: system-historical, logical-historical, chronological and diachronous; functional-structural analysis, which includes various subsystems; systematization and generalization of the processed materials to formulate conclusions, recommendations and determine ways of further development of cloud technologies in education.

4. Results and discussion

The now popular term "cloud computing" has been used in the field of information technology since 2008. The first person to use the phrase "cloud computing" was Eric Schmidt, CEO of Google.

Cloud technologies are a model for providing network access to computing resources (data transmission networks, servers, storage devices, applications and services, etc.). Cloud consumers can significantly reduce the cost of information technology infrastructure and flexibly respond to changes in computing needs, using the properties of computational suppleness of cloud services [17]. Cloud computing is a paradigm that provides for remote data processing and storage [5].

The term "cloud" comes from the English "cloud", but in a different sense the same token is translated as "scattered, distributed". Therefore, cloud computing, in fact, are "distributed technologies", that is, data processing takes place using not one desktop computer, but is distributed in computers connected to the Internet [20].

As A. Kuh notes, cloud computing is a technology that provides internet users with access to computer resources of the server, the use of software as an online service. If you have an internet connection, you can perform complex calculations and process data using the power of a remote server [11].

Cloud computing includes a browser-based mailbox interface, the ability to create and edit Office documents online, and complex mathematical calculations for which the power of one personal computer is not enough. So, cloud computing is a data processing technologies that provide the internet user with computer resources as online services [20].

V. Oleksiuk understands cloud technologies (cloud computing) as a model for providing ubiquitous and convenient network access on demand to a certain set of configurable computing resources. Cloud also considers software and hardware that is available to the user via the Internet or a local network in the form of a service that allows you to use a user-friendly interface for accessing certain computing resources, programs, and data. "Cloud" is not only a popular modern term used to describe internet technologies for remote data storage. It is usually described using the following concepts: software, service, and server. However, the main criterion for determining a cloud technology is the ability to work with its resources, regardless of the client's hardware and software, as well as its geographical location. For example, a student can use a laptop, tablet computer, or smartphone to get information about modular control while at university, at home, in a library, or in a cafe. Cloud computing technologies provide a new approach that reduces the complexity of IT systems by applying a wide range of efficient on-demand technologies that operate within the virtual infrastructure [13].

Cloud technologies have proven to be very effective in meeting educational needs. There are different approaches to educational technologies. Higher education now faces the challenge of managing and understanding large and growing amounts of data, from student and teacher information to complex analytics and research. Cloud computing is understood as distributed data processing technologies, when computer resources and capacities are provided to the user as an internet service. Cloud technologies are data processing technologies in which computer resources are provided to the internet user as online services [19].

Modern educational IT applications and cloud technologies are powerful information tools for modernizing the professional training of future specialists. They form the information and technological basis of the information environment of modern educational activities in higher educational institutions. On this basis, constant information and technological modernization of the information educational space is carried out, educational processes are being improved that significantly contribute to the growth of information competence of future specialists. Such processes serve to improve the quality of educational services and integrate them into the global educational space. Cloud technologies are effectively used in the educational process of future specialists. They allow you to organize such a process productively and efficiently. Therefore, cloud technologies are a dynamic process of increasing service productivity or technological capabilities, without investing in the new infrastructure of an educational institution, improving the educational process of future specialists, and reducing software licensing costs [6].

The purpose of forming a cloud-based educational environment is to create the most favorable conditions for personal development and achievement of learning goals, which together should ensure adaptation, emotional and personal well-being, educational and professional motivation, personal achievements and other psychological characteristics of a person who is in a state of comfort, high efficiency and readiness for personal growth. The defining components in the digital educational space are cloud services, the latest type of network services provided to the user of information and communication networks with a virtualized ICT infrastructure. Cloud services are currently a full-fledged educational tool that allows an educational institution to create its own online space and form the personal educational environment of applicants and teachers as effectively as possible [7].

Cloud computing offers the following services:

- use of software;
- a platform as a service ("software as a Service "("SaaS")) that provides access to an integrated platform for developing, testing and supporting various projects;

- infrastructure as a service ("IaaS") – representation of a computer infrastructure in the form of virtualization, containing operating systems and system software, as well as server hardware;

- virtual workplace ("Desktop as a Service "("DaaS")) – the user has the opportunity to set up their own workplace, create a set of software necessary for their activities.

In general, these technologies have both advantages and disadvantages. Cloud technologies are quite economical and appropriate for organizations, corporations, firms, etc. They do not require large resources of the user's device (PDA, tablet, smartphone, netbook or computer), but they are demanding in terms of internet access. This means that the user must have constant high-speed Internet. Companies that provide these services try to work online all the time, but there are always cases when the server may be disconnected (offline), then access to the services will not be available.

Cloud computing and the educational platform implemented on their basis help to maximize the use of available software and hardware resources of higher education institutions, schools, and gymnasiums. Students and pupils get the opportunity to apply the most modern computer technologies in practice. In any classroom, you can organize a modern educational process using laptops and a wireless network. To work under the guidance of a teacher, students need tablets, laptops, or netbooks that support a wireless Wi-Fi connection. The electronic educational space is filled with teachers and students of higher education institutions.

Among the main advantages of using cloud computing by an educational institution are the following:

- save money for purchasing software (using the "Office Web Apps" technology ("Office" Online));

- reducing the need for specialized premises;

- performing many types of educational work, monitoring and evaluation online;

- save disk space;

- anti-virus, anti-hacker security, openness of the educational environment for teachers and students.

Operating with cloud computing in schools and institutions of Higher Education makes it possible to use Web applications; electronic journals; online services for the educational process, communication, testing; distance learning systems, libraries, media libraries; file storage; collaboration; video conferences; using e-mail with the domain of the educational institution [11].

V. Bykov believes that the main advantages of cloud technologies for implementation in organizations are their availability; mobility; cost-effectiveness; flexibility; reliability; security; fast implementation; high manufacturability [1].

Among the advantages of cloud computing, you can note access to materials anywhere; the ability to use video and audio files directly from the internet, conduct online trainings, round tables, etc. The use of cloud technologies in the educational process makes it possible to form the professional culture of a future specialist, adapt the educational material to real life. The technology of using cloud services offers an innovative alternative to traditional learning, and the network cloud allows students to interact and work together regardless of their location [19].

In the educational process, "cloud computing" are not yet widely used, although the modern younger generation has information about "cloud computing" and uses some of them in their activities. The sooner professors, teachers, and managers start using cloud services in their work, the sooner they will get an effective tool for building an individual learning trajectory, and the learning process will become more effective and interesting [9].

The emergence of the first technology, which can be described as "cloud", is associated with the company "Salesforce.com", founded in 1999, which provided access to its application through the site on the principle of "Software as a Service" ["SaaS"]. The next step was the development of a "cloud" web service by Amazon in 2002. This service allowed you to store information and perform calculations. In 2006, Amazon offered a service called Elastic Compute cloud ("EC2") as a web service that allowed users to run their own applications. In the same year, Google began implementing "SaaS" - services called "Google Apps" and platforms as services ("Platform as a Service "["PaaS"]), which are called "Google App Engine".

Microsoft prepared its first presentation of "PaaS " – "Azure Services Platform", which took place at the 2008 Professional Developer's Conferences ("PDC") and became a significant step towards the development of cloud computing. Nowadays, these technologies are becoming increasingly important in the professional activities of specialists in almost all vital industries and institutions of Higher Education. This is primarily due to new opportunities for presenting dynamic and relevant electronic applications for education and society based on internet technologies. The main companies ("Google"," Microsoft"," IBM") that develop such products are trying to improve cloud computing for their implementation in the educational process, in particular in the professional activities of specialists. So, the company "TechExpert" offers integration of services "Microsoft Office 365", previously known as "Microsoft Live@edu", in the information structure of the educational process of educational institutions.

Cloud computing "Microsoft Office 365" is a free solution for organizing email, interaction and collaboration of training participants. At the same time, they perform the following tasks:

- organization of e-mail in the domain of the educational institution, available in any browser, mobile phone or in an email client that uses the "Exchange", "Imap", "POP3" standards;

- create an online class schedule available directly from mail;
- preparation of personal and shared file repositories;
- organization of collaboration space, etc.

The company "TechExpert" offers a range of services: analysis of the existing IT infrastructure; creation or adjustment of IT infrastructure to solve problems of the educational process; configuration of mail services, access levels; migration of the database of accounts from the current system to the new, development of a system for automatic creation of new accounts; training of users and administrators; user instructions; recommendations for more effective work with the services of "Microsoft Office 365". "Microsoft" partners have created a Growing Learning Community, namely a global network - "pil-network.com", which already serves more than two million professors and managers around the world. The community's mission is to help professionals achieve success by bringing them together professionally. IBM Corporation also announced cloud services for Education ("IBM SmartCloud for Education"), thanks to which students, pupils, teachers and scientists can access modern information resources and services of computing laboratories without involving specialists. Consequently, educational institutions were able to compensate for the lack of IT resources for training, research and professional development [14].

To improve the quality of higher education, it is necessary to turn the future specialist from a passive consumer of knowledge into an active search engine, who can formulate a problem, analyze ways to solve it, find the optimal result and prove its correctness. The role of independent work of students is undergoing actualization, which means a fundamental revision of the organization of the educational process of a higher education institution, which should be built in such a way as to develop the ability to learn, form the student's ability to self-development, creative application of the acquired knowledge, teach ways to adapt to professional activities in the modern informatized world.

Serving as a powerful tool for Open Education, network clouds open up new educational opportunities for those who are not able to learn in the traditional way: people with special needs, the elderly, citizens who work, etc. Cloud learning tools increase the share of group and active forms of learning activities of students, intensify their independence in mastering knowledge, skills, and technologically integrate classroom and extra-curricular work using combined training. Influencing the means, methods and forms of training organization, cloud computing affects the methodological system of training in each discipline.

The introduction of cloud technologies in the educational process makes it possible:

- reduce hardware and software costs;
- creating virtual environments for students and teachers (the student can go to the desired page and get access to the materials of training courses, comments and answers of the teacher);
- organization of virtual classrooms and laboratories where conferences, lectures, seminars, trainings, etc. are held;
- mobile access to Information Resources and internet services by using smartphones, netbooks, etc. ;
- expansion of the communicative field "student – teacher", "student – student" outside the educational institution;
- providing equal opportunities for students to use quality curricula regardless of their place of residence and study;
- organization of electronic document management of an educational institution;
- increase the available computing power and the amount of data stored.

At the same time, cloud-computing helps to organize training anywhere and anytime; they have a personal orientation, portability and mobility of learning tools; high interactivity of learning; developed collaboration tools; continuous access to educational materials. Cloud technologies should be used in teaching both for its direct organization and for integrating various technologies in networks in order to strengthen the forms and methods of interaction between teachers and students, students among themselves, and students' use of resources of the unified information space of the higher education system [21]. General education institutions have also begun to join the use of cloud technologies, although not in a large – scale, global dimension covering a city or district, but in a local one - at the level of one educational institution. Currently, there are two areas of organization of the educational process, management of an educational institution or methodological work by means of cloud computing recognized by the community of subject teachers - these are the services "Google" and "Microsoft".

The type of cloud depends on its purpose; there are community clouds, public clouds, private clouds, and hybrid clouds. In practice, the boundaries between all these types of calculations are blurred. Differentiated forms of using cloud computing in education: virtual subject communities, "virtual teachers'", "virtual teaching rooms", "virtual classes", "virtual document management", electronic diary and journal, interactive reception, thematic forum, organization of independent work of students and optional training, content storage.

Necessary components for using cloud technologies: Internet, computer (laptop, tablet, mobile phone, netbook), browser, company that provides cloud technology services, skills in working with the Internet and web applications. The cloud supports a number of activities: communication, collaboration, and cooperation.

Communication is the process of exchanging information (facts, ideas, views, emotions, etc.) between two or more people. Collaboration – a joint activity, for example in the intellectual sphere, of two or more individuals or organizations to achieve common goals, in which knowledge is exchanged, training and agreement is reached. Usually, such a process requires a governing body, and the form of leadership can also be public in the case of cooperation between equal members of a decentralized community. It is believed that participants in the collaboration get more opportunities to achieve success in the face of competition for limited resources. Cooperation - partnership, interrelation of people in the processes of their activities [12]. A secondary school as a cloud object has a number of structural elements. The teachers' room is not only a place to store magazines and bulletin boards, but also a place in, the school where teachers exchange opinions, receive advice from colleagues or consultation. A virtual teacher's room is a place created with the help of cloud computing for collaboration, communication and cooperation of teachers in order to effectively manage the educational process. It functions according to the principles of voluntariness (each teacher voluntarily expresses the intention to participate in the use of virtual teacher's room), hierarchy (clear distribution of rights to use data in virtual teacher's room, open exchange of information related to school studies, accessibility for all teachers); collective use of data (the teacher has access to the collective creation and use of documents that receives from other participants in the educational process) copyright (all teachers undertake to comply with copyright legislation); instant feedback (each teacher gets the right to instantly connect with another teacher or head of the institution in case of if necessary).

The virtual teacher's room uses the following types of documents: sharing documents; template documents; documents for review; documents for execution. Shared documents are static interim reports, such as the number of missing students in a class. Template documents require compliance with a single structure, such as student performance reports for the first and second half of the year, certification sheets, analysis of test papers, and so on. Documents for review – a variety of information on educational work, for example, information for classroom teachers on organizing excursions, competitions, and so on. Documents for execution require processing or communicating information to parents.

Among the positive aspects of the introduction of "virtual teacher" is access to data anywhere and anytime, availability and transparency of Information, speed of informing the pedagogical collective, storing all information in one place, sharing experience and training teachers, transparency of each teacher's activities, automation and unification of reporting, participation of teachers in management, organization of joint work, etc.

The features of implementing "virtual teacher room" are outlined: additional training to work with "virtual teacher room", methodological support for teachers, strengthening control over the implementation and updating of documentation, updating motivation, encouragement, material interest in implementing "virtual teacher room", availability of high-speed Internet, updating computer equipment, additional explanatory work with the team.

The structure of the virtual teaching profession contains the main blocks corresponding to the structure of the school's activities: deputy director for educational work

- methodological association of subject teachers

– documents (certification, announcements, competitions, substitutions, reports for the first half of the year, reports for the second half of the year, olympiads, curricula, methodological recommendations, etc.) [12].

The powerful force of the cloud also lies in online content and open editing resources, most of which are provided free, which is also quite important. The Khan Academy library is an eloquent example (www.khanacademy.org), which offers more than 2,400 free video lectures in all subjects – from arithmetic to physics, finance and history. Free online video opens up unprecedented opportunities for any specialist [4].

The technology of cloud computing and the educational platform implemented on its basis help to make the most efficient use of the available software and hardware resources of an educational institution. Those who study get the opportunity to apply the most modern computer technologies in practice. Now you can organize a modern educational process in any classroom using laptops and a wireless network. Students work on tablets, laptops, or netbooks that support wireless Wi-Fi connectivity. The electronic educational space of an educational institution is filled with teachers [3].

Management of an educational institution is a scientifically based action of the administration and teachers aimed at rational use of the time and effort of teachers and students in the educational process for in – depth mastering of subjects, moral education, preparation for an informed choice of profession and comprehensive personal development [12].

Among the areas of ICT development, cloud technologies are among the most attractive for teachers. Informatization of society provides for advanced informatization of the field of science and education, where the cognitive, personnel, scientific and technical foundation of informatization as a process and socio-economic phenomenon, the future of achievements and development of society as a whole are formed [2].

It is cloud computing, which are now advanced technologies of the information society, that can play the role of the leading tool for informatization of higher education [15], since the need for the formation of the young generation of skills of independent, critical,

operational thinking, adaptation and orientation in the information-saturated space violates radically new requirements for the content of Education.

It should have the features of advanced training, have a projective, innovative character; take into account the consistency and integrativeness of the development of modern science; form sustainable models of the future based on their own creativity, culture, tolerance in relationships and internal spirituality; direct to effective strategies for human self-realization, effectively solve existing and potential problems.

The development of Education based on the principles of continuity, equal access, and personal orientation forms a conceptually new model of Education – Open Education, which is designed to implement the idea of lifelong learning, recognized by the Council of Europe as one of the most important social elements. Compared to traditional education, Open Education has a more complex structure and philosophy, and its introduction does not mean a change in pedagogical content. We are probably talking about updating methodological principles. The basis of the educational process in open education is purposeful, controlled, intensive independent work of the student, who can study in a convenient place, according to an individual schedule, using a set of special training tools and a coordinated opportunity to contact the teacher and each other. The purpose of open education is to prepare students for full and effective participation in public and professional activities in the information society [22].

Conclusions

Therefore, science at all stages of its development is constantly searching for ways to improve the effectiveness of learning. Now learning using computer technologies is becoming a new educational standard, where information is presented in a logical sequence, computer-training systems have powerful functions for implementing the educational process. The latest technologies help to achieve the highest level of knowledge of students, increase interest, form a positive attitude to the subject, diversify the education system, strengthen conscious motivation to learn, and improve the quality of students' knowledge.

The use of cloud computing in the professional activities of specialists is too promising and necessary. Currently, cloud technologies are a global concept that covers many different concepts: software, infrastructure, platform, data, workplace, etc. The main function of cloud computing is to meet the needs of users who require remote data processing, which will be the focus of our further research.

References

[1] Bykov V. Yu. (2011). Cloud computing technologies – leading information technologies for the further development of informatization of the education system of Ukraine. *Computer in school and family*. 6. 3–11.

[2] Bykov V. Yu. (2011). Cloud technologies, ICT outsourcing and new functions of ICT departments of educational and scientific institutions. *Information technologies in education.* 10. 8–23.

[3] Cloud educational technologies – a tool for creating an information environment for the interaction of participants in the educational process URL: http://metodportal.net/system/files/mp/2013/03/17471/hmarni_servisy_v_nvp.docx

[4] Cloud technologies for education URL: http://www.harmony-gymnasia.kiev.ua/?page=cloud

[5] Cloud technologies URL: http://j.parus.ua/ua/358/

[6] Karabin O. Y. Kryshchuk B. S. (2018). Modernization of professional training of future specialists by means of cloud technologies. *Modern information technologies and innovative teaching methods: experience, trends, prospects*. 2. Section: Innovative technologies of digital education in higher and secondary schools of Ukraine and the countries of the European Union. 199-202.

[7] Kosyk V.M. Tropina M.A. (2021). The potential of cloud technologies for the tasks of automated design systems in the conditions of digitization of education. *Scientific Bulletin of Uzhhorod University*. Series: "Pedagogy. Social work". 1 (48). 194-198.

[8] Kotiash, I., Shevchuk, I., Borysonok, M., Matviienko, I., Popov, M., Terekhov, V., Kuchai O. (2022). Possibilities of Using Multimedia Technologies in Education. *IJCSNS International Journal of Computer Science and Network Security*, 22(6), 727-732.

[9] Kuchai O.V. (2014). Theoretical and methodological principles of training future primary school teachers using multimedia technologies in higher educational institutions of Poland / monograph edited by A.I. Kuzminsky Cherkasy: publisher Chabanenko Yu. A. 361.

[10] Kuchai, O., Skyba, K., Demchenko, A., Savchenko, N, Necheporuk, Y., & Rezvan, O. (2022). The Importance of Multimedia Education in the Informatization of Society. *IJCSNS International Journal of Computer Science and Network Security,* 22(4), 797-803.

[11] Kuh A. M. Laboratory work No. 1. Cloud technologies theoretical information. URL: http://kukh.ho.ua/kurs/KITON/H1.pdf

[12] Litvynova S. (2013). Cloud technologies as a means of building an innovative school. URL: http://virt-ikt.blogspot.com/2013/10/blog-post_28.html#more

[13] Oleksyuk V. (2018). Fundamentals of cloud technologies. Ternopil: Ternopil Regional Communal Institute of Postgraduate Pedagogical Education. 156.

[14] Shinenko M.A., Soroko N.V. Using cloud technologies for professional development of teachers (foreign experience). URL: http://ite.kspu.edu/webfm_send/308

[15] Shishkina M. P. (2012). Modern trends in the formation and development of the scientific and educational environment of a higher educational institution. *Cloud technologies in education.* Materials of the All-Ukrainian Scientific and Methodological Internet Seminar (December 21, 2012). Kryvyi Rih - Kyiv - Cherkasy - Kharkiv. 7-8.

[16] Shunkov, V., Shevtsova, O., Koval, V., Grygorenko, T., Yefymenko, L., Smolianko, Y., Kuchai, O. (2022). Prospective Directions of Using Multimedia Technologies in the Training of Future Specialists. *IJCSNS International Journal of Computer Science and Network Security*, 22(6), 739-746.
[17] Softline-IT. URL: http://www.softline.kiev.ua/ua/khmarni-poslugi.html
[18] Vakalyuk T.A. (2016). Cloud technologies in education. *Educational and methodological manual for students of the Faculty of Physics and Mathematics.* Zhytomyr: ZhDU branch. 72.
[19] Voznyuk O.M., Lekhitskyi T.V. (2021). Formation of the professional culture of future specialists through the aspects of learning with cloud technologies. *Innovative pedagogy*. 41 (1). 92-95.
[20] Who needs cloud technologies? Consulting in Ukraine URL: http://consulting-ua.com/komu-potribni-hmarni-tehnolohiji/
[21] Yatsko O. M. (2013). Cloud technologies in teaching informatics of future economists URL: http://tmn.ccjournals.eu/index.php/cte/2013/paper/downloadSuppFile /62/46
[22] Zaporozhchenko Y. G. (2012). Cloud technologies as means of open education. *Cloud technologies in education.* Materials of the All-Ukrainian Scientific and Methodological Internet Seminar (December 21, 2012). Kryvyi Rih - Kyiv - Cherkasy - Kharkiv. 57-59.

МУКАЧІВСЬКИЙ ДЕРЖАВНИЙ УНІВЕРСИТЕТ

89600, м. Мукачево, вул. Ужгородська, 26
тел./факс +380-3131-21109
Веб-сайт університету: www.msu.edu.ua
E-mail: info@msu.edu.ua, pr@mail.msu.edu.ua
Веб-сайт Інституційного репозитарію Наукової бібліотеки МДУ: http://dspace.msu.edu.ua:8080
Веб-сайт Наукової бібліотеки МДУ: http://msu.edu.ua/library/