Cloud and education: transforming teacher training

Хмара та освіта: трансформація підготовки вчителів

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Abstract

The article clarifies mandatory approaches, forms, and resources of learning in a cloud-oriented environment; the possibilities of realizing the advantages of the latest technologies in research institutions are revealed; highlighted the peculiarities of the introduction of cloud technologies in the countries of the European Union and the USA. In the process of research, the ways of ensuring the integration of all components of cloud technologies have been identified. With the aim of changes and innovations of all their components, the main integration functions, factors, and principles of cloud technologies are shown in the preparation and retraining of future teachers-practitioners. This work allowed us to conduct a study that contributed to the development, substantiation, and experimental verification of ways of using a cloud-oriented educational setting for the creation of the qualified position of a teacher. As a result of the experimental work, we observe an increase in the level of IC-competence of

Анотація

У статті з'ясовано обов'язкові методи, форми та засоби навчання у хмаро орієнтованому середовищі; розкрито можливості реалізації переваг новітніх технологій в науково-дослідних установах; вивчено особливості впровадження хмарних технологій у країнах Європейського Союзу та США. У процесі дослідження виокремлено шляхи забезпечення інтеграції всіх компонентів хмарних технологій. З метою змін і інновацій всіх їх складових показано основні інтеграційні функції, чинники й принципи хмарних технологій при підготовці та перепідготовці майбутніх педагогів-практиків у хмаро орієнтованому освітньо-науковому середовищі. Така проробка роботи дозволила нам провести дослідження, яке сприяло розробці, обґрунтуванню та експериментальній перевірці шляхів використання хмаро орієнтованого освітньо-наукового середовища для формування професійної позиції педагога. У результаті проведення експериментальної

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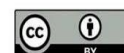
teachers, which is possible in a cloud-oriented educational and is a necessary condition for the formation of the professional position of a teacher.

Keywords: cloud-oriented educational and scientific environment, professional position of a teacher, cloud technologies, training and retraining of future teachers, professional development.

роботи спостерігаємо підвищення рівня IK компетентності педагогів, що можливо у хмаро орієнтованому освітньо-науковому середовищі та є необхідною умовою для формування професійної позиції педагога.

Ключові слова: хмаро орієнтоване освітньо-науковове середовище, професійна позиція педагога, хмарні технології, підготовка та перепідготовка майбутніх педагогів, підвищення кваліфікації фахівців.

Introduction

In modern society, it is necessary to introduce information technologies into educational practice and update the ways of their application in conditions of rapid development. The future teacher must be ready to create new things, be able to quickly adapt to innovations, rely on the acquired skills, abilities, and knowledge, and be able to creatively apply them during the implementation of professional tasks that arise in the process of educating students and their training. With this approach to education, there is an increased emphasis on the problem of improving the process of forming a teacher's professional position, that is, the readiness of future teachers for modern professional activities (Khmil, 2017).

It is cloud technologies that most satisfy the needs of solving important and necessary educational, cultural, and social problems of the modern information society. The most significant of them are the improvement of the level of quality and accessibility of teaching, the interconnection of the processes of training methodical and educational workers and scientific research, ensuring and shaping the functioning of the educational environment of educational institutions, and improving their design. These technologies are promising and become a tool for the implementation of equal access to education, and the principles of human-centeredness in pedagogical systems of higher education (Nosenko et al., 2016).

The relevance of the process of forming the professional position of a teacher using cloud technologies is due to the need to increase the effectiveness and efficiency of the introduction of information and communication technologies, cloud computing, which are recognized in the modern European educational space as leading ICT tools, into the educational process of higher education institutions, to improve the level of personnel training, and to improve the indicators of their use cloud technologies.

The article focuses on the following main aspects:

– mandatory methods, forms, and means of learning in a cloud-oriented environment; possibilities of realizing the advantages of the latest technologies in research institutions;
– support for the implementation of cloud technologies by the state policy of the countries of the European Union regarding the improvement of the qualifications of teachers and their quality training;
– peculiarities of training and retraining of future practicing teachers in the USA regarding the possibility of using cloud technologies in the educational space for the possibility of creating a cloud-oriented educational and scientific environment to form the professional position of the teacher;
– ensuring the integration of all components of cloud technologies, with the aim of changes and innovations of all their components;
– integrative functions of cloud technologies in the preparation and retraining of future pedagogues-practitioners in a cloud-oriented educational and scientific environment;
– the factors of the formation of a cloud-oriented environment and the principles of the formation of a cloud-oriented educational and scientific environment contribute to the formation of the professional position of the teacher;
– experimental verification of the effectiveness of the ways of using a cloud-oriented educational and scientific environment for the formation of the teacher's professional position;
– recommendations for the use of cloud services in the formation of the teacher's professional position;
– important cloud services should be used in a cloud-oriented educational and scientific environment for the formation of the professional position of a teacher.

Literature review

Based on the preliminary analysis of psychological and pedagogical literature, we conclude that the educational process in higher education in modern society should be built taking into account the individual capabilities and characteristics of higher education students, their interests, abilities, and needs while creating optimal conditions for the formation of their professional position. formation, development, and realization of natural potentials. A special place in our research is devoted to the formation of the teacher's professional position, his methodological tactics and strategy, and the formation of professional readiness for the use of cloud technologies by future teachers in the educational process. Thus, N. Khmil (2017) proved the importance and necessity of a personally oriented approach in forming the professional position of a teacher and the readiness of future specialists to use cloud technologies in the educational process. The author systematized the signs of a personally oriented approach and provided an interpretation of the main researched concepts. The author's approach to ways of implementing a personally oriented approach during student training using cloud technologies is proposed. The need to take into account the features of a personally oriented approach to ensure the conditions for the development of future teachers' abilities for self-improvement, self-education, self-realization of self-development concerning the mastery of cloud technologies by students of education and the methods of their application in educational institutions is proven.

For teachers, scientific-pedagogical and scientific workers, and students of educational institutions Yu. Nosenko, M. Popel, & M. Shyshkina (2016) to form a cloud-oriented didactic and methodical setting of an educational and pedagogical institution offered recommendations which the authors on the basics of using cloud services of the educational and scientific environment theoretical information covering the criteria for the selection of resources and means, the conceptual apparatus, modeling of the environment structure is provided. The methodological foundations of the formation of research and pedagogical skills are shown in the examples of using Office 365 and Google services: text editor, electronic calendar, e-mail, electronic notebook, e-book, file storage, etc. The possibilities of using SageMathCloud are described: the creation of educational resources such as course, sage-chat, sagews; the project and its components; with the help of standard control elements, the technology of developing interactive models is considered.

Scientists P. Quezada-Sarmiento, C. Suárez-Guerrero, M. Narvaez-Rios & L. Gutiérrez-Albán (2022) in their article propose a pedagogical methodology that allows the use of cloud computing tools as complementary material in the development of computational and military skills: navigation, understanding and reading of charts. The authors present and reflect on how to incorporate the map into educational processes, strengthening positioning skills and competencies in orientation exercises. This article is part of the research project Design of a Pedagogical Model based on Cloud Computing and Affective Computing for the development of computational skills at Valencia University. In conclusion, the use of Cloud Computing tools allowed generating an environment of greater interactivity between teachers and the soldiers in training likewise, it allowed to generate an adequate educational process.

The problem of optimization and Scalability of Educational Platforms: Integration of Artificial Intelligence and Cloud Computing is highlighted in their research by J. Govea, E. Ocampo Edye, S. Revelo-Tapia & W. Villegas-Ch (2023). They emphasize that the intersection between technology and education has taken on unprecedented relevance, driven by the promise of transforming teaching and learning through advanced digital tools. This study proposes a comprehensive exploration of how cloud computing and artificial intelligence converge to impact education, focusing on accessibility, efficiency, and quality of learning.

L. Machado, F. Rita & C. Santos (2017) emphasize a brief survey about cloud and mobile integrated technologies and their possible contributions to support centralized data management in educational systems, relating improvements in governance, data security, mobility, economic viability, and environmental impact. Therefore, this work also presents a list of already free and private technologies and their advantages and disadvantages in the Brazilian scenario. In this sense, the herein technological aspects consider the integration between cloud and mobile technologies as an essential alternative to suppress online requirements, which is a limitation for a large number of public institutions that have problems being effectively connected to the Internet.

The practice of using cloud facilities of teachers

of Ukraine in the organization of general secondary education is interesting, disclosed, and grouped by S. Lytvynova (2016). The author presents the results of the use of cloud services in management activities and the educational process by teachers of educational institutions in Ukraine under the implementation of the All-Ukrainian project "Cloud Services in Education". The main forms, directions, and methods of using Office 365 cloud services are disclosed: Outlook Online e-mail, Sway, OneNote Classroom, electronic calendar, Skype (Lync) Online, Word Online text editor, OneNote electronic notebook, Excel Online e-book, Yammer network, presentation editor PowerPoint Online, personalized learning environment OneNote Class. The material is valuable for teachers of higher education institutions, teachers of educational institutions, students of higher education institutions, and scientists.

L. Sikoraka (2019) showed the ways of using cloud technology of higher education institutions, which makes it possible to quickly update informational material, is economically and strategically beneficial, and provides a flexible way of satisfying the education of those seeking education. Using concrete examples, the scientist shows the ways of using cloud technologies at various stages of the lesson "Fundamentals of Industry Economy and Entrepreneurship".

In the works of M. Zhaldak, & Yu. Tryus (2005) and T. Kobylnyk (2009) show that one of the main components of the fundamentalization of IT training of higher education students, the formation of the professional position of a teacher using cloud technologies is the teaching of mathematical informatics, which, founded on the practice of technologies and information systems for solving applied problems, is a component of theoretical informatics, where tools and mathematical models are used to study information processes and modeling in various spheres of human activity.

Despite the existence of existing scientific works on the issue of the formation of professional readiness of future teachers for the use of cloud technologies in the educational process and the significance of this problem for higher pedagogical education, it remains underdeveloped. Aspects such as systematic presentation of theoretical-methodological and methodical aspects require more thorough research on the principles of professional training of future teachers for the use of cloud technologies in the educational process,

clarifying the principles and regularities of this process; substantiating the conditions, content, methods, forms and means of training future teachers for the use of cloud technologies in the educational process.

The analysis of theory and practice on the researched problem revealed several contradictions between the need for teachers who can innovatively organize the educational process using cloud technologies for the comprehensive development of students, and the lack of a system for forming the professional readiness of future teachers for this area of professional activity; potential opportunities of cloud technologies as an innovative tool in the field of education and the insufficient level of their use in educational activities; multifaceted pedagogical possibilities of cloud technologies and their fragmentary presentation in the content of professional training of future teachers; constant improvement of cloud services and insufficient readiness of future teachers to independently master theirs opportunities for further effective application in the educational process.

Methodology

The purpose of the article: is to develop, substantiate, and experimentally verify the ways of using a cloud-oriented educational environment for the formation of the teacher's professional position.

The object of the study is the process of creating a cloud-oriented learning environment for an educational institution.

The subject of the study: the formation of the professional position of the teacher using cloud technologies.

The task of the research: to outline the main characteristics of the cloud-oriented educational environment of the educational institution; construct the activities of higher education students and teachers, show ways of organizing their interaction during the educational process, optional classes, extracurricular activities, etc.; analyze the use of electronic instructive properties in a cloud-oriented educational environment; to develop methodological guidelines for the development of the educator's qualified position using cloud technologies, the use of a cloud-oriented educational environment.

To achieve the goal and solve the tasks, the following methods of scientific knowledge were used:

– *theoretical methods*, to study and analyze normative sources, psychological, philosophical, methodical, and pedagogical literature; comparative analysis of the scientific work of foreign scientists and domestic scientists on the problem of forming the professional position of a teacher using cloud technologies to outline the semantic load of the studied phenomenon and its conceptual boundaries; logical-systemic analysis, which includes: analogy, classification, deduction, induction, and generalization of practical and theoretical data to determine ways of forming the professional position of a teacher using cloud technologies;

– *empirical methods* – observations, and questionnaires to find out and check the effectiveness of implementing ways of forming the teacher's professional position using cloud technologies; comparison of obtained experimental data to clarify dependencies and causal relationships.

When determining the sample of subjects, the general specificity of the subject of the study was taken into account. The total sample size is 40 subjects. When forming the sample, the criteria of meaningfulness, representativeness, and equivalence were taken into account. The sample was formed by random selection using the technical procedure for calculating the selection step.

The training and retraining of higher school teachers for the use of cloud services in a cloud-oriented educational and scientific environment for the formation of the teacher's professional position was carried out in three stages.

In the first stage, we offered the training "Designing a cloud-oriented educational environment".

In the second stage, respondents were offered a course on intensive use of services as part of summer training.

In the third stage, during the seminar, the respondents presented their best practical solutions regarding the use of cloud services for educational purposes for the formation of the teacher's professional position.

Table 1.
The level of IR competence of future specialists

The level of IR competence of future specialists	%
Teachers' understanding of the importance and necessity of forming the professional position of future cloud service specialists in a cloud-oriented educational and scientific environment	43%
The use of cloud services by teachers in their professional activities	48%
The basic knowledge of future specialists about the possibilities of cloud services	47%
The possibility of cooperation using cloud services in a cloud-oriented educational and scientific environment	45%
With the help of cloud services, the use of various forms of educational activities for the formation of the teacher's professional position	47%
For the formation of the professional position of the teacher in the training of higher education seekers, the use of basic services	48%

So, the training of teachers in new information and communication technologies, in particular cloud services during the formation of the professional position of a teacher in a cloud-oriented educational and scientific environment, made it possible to determine that: specialists are actively improving their knowledge. qualifications in the field of ICT; no problems with missing devices; systematic training in three stages gives significant results in the development of the intellectual competence of the individual during the formation of the professional position of the teacher; cloud services become an effective tool in the cloud-oriented educational and scientific environment of a higher school during the organization of cooperation and joint work of teachers and students of education.

The reliability and validity of the obtained results, and the objectivity of their assessment were ensured by the methodological soundness of the initial positions and the qualitative mechanism for evaluating the quality under study, the use of a complex of complementary research methods, and the involvement of a group of respondents from a higher educational institution in the analysis of its results.

To assess the homogeneity of experimental and control data, statistical processing was performed using MS Excel and SPSS (Statistical Package for Social Science).

Results and discussion

Today, new information technologies are emerging, which, being integrated into the educational process, change the traditional ones and contribute to the emergence of new methods, forms, and means of learning. Among such technologies, cloud technologies are now preferred as they play an important role in the creation of modern informational educational environments, the implementation of e-learning; contribute to the organization of joint and continuous access to educational information resources; ensure the organization of joint network interaction of participants in the educational process. Given this accelerated the process of their active introduction into education requires the teacher of professional knowledge and skills to consciously apply the pedagogical potential of these technologies for improving the quality of the educational process, as well as the comprehensive development of the young generation. Solving the problem requires the development of a strategy for professional training of future teachers for the use of cloud technologies in the educational process.

In connection with the above, in this section we have defined the following issues: ensuring the integration of all components of cloud technologies, with the aim of changes and innovations of all their components; integrative functions of cloud technologies in the training and retraining of future pedagogues-practitioners in a cloud-oriented educational and scientific environment; the factors of cloud-oriented environment formation and the principles of cloud-oriented educational and scientific environment formation contribute to the formation of the teacher's professional position. We also experimentally verified the effectiveness of ways to use a cloud-based educational and scientific environment for the formation of a teacher's professional position; recommendations are made regarding the use of cloud services in the formation of the teacher's professional position.

A democratic open system – the Internet is currently the most prominent means of information skills. The Internet covers millions of users. The following achievements of the scientific and technical revolution can be used for educational purposes: for any branch of science,

the operational reproduction and transfer of information; operation and preservation of data obtained by students during research and educational activities; according to the level of knowledge formation, control is mandatory (Kaynak et al., 2023).

Students are obliged to prepare abstracts, scientific projects, theses of reports, essays, etc., which involve actively searching for the necessary information on the Internet. Without the teacher's guidance, the learner resorts to spontaneous and chaotic use of Internet resources. However, the help of the teacher in performing research and scientific tasks with the help of the Internet is only a small part of the possibilities of the Internet. Only cloud technologies allow you to use the full capabilities of Internet resources.

Scientists, in a broad sense, consider cloud technologies (English cloud technologies) to be a model of data processing that provides convenient, affordable, ubiquitous network access to servers, general storage of resources, applications and services, etc. So, cloud technologies are understood as a set of tools that provide processing, transfer, and storage of data on servers of the worldwide network from personal devices (Danysko & Kornosenko, 2019).

To implement cloud services in a higher education institution, it is necessary to introduce appropriate elements of education, conduct appropriate training, first of all, introduce innovative approaches to the content of training, upgrade the qualifications of personnel, and retrain specialists. The content of training to form the professional position of a teacher should be aimed at forming the ICT competence of teachers, employees of ICT sectors, students, and graduate students regarding the high-quality and free use of services in the didactic process and scientific research.

Mandatory methods, forms, and means of learning in a cloud-oriented environment.

Learning methods used in a cloud-oriented environment are:

– practical (practical and laboratory work, solving problems, exercises, etc.);
– verbal (explanations, lectures, conversations);
– research (heuristic, problem-search, partial-search).

Forms of education are educational (special) courses, individual consultations, trainings, webinars, seminars, web conferences, etc. Among the innovative forms of training that are implemented only in a cloud-oriented environment is the use of combined training, which combines remote and face-to-face forms of work. During the training, an electronic situational learning network is created, where the participants are directed to implement high-quality collective activities according to a common scenario. The organizer of the training shows examples of high-quality successful activities. This can be preliminary material in the templates of educational tasks, interactive use of means of audio and visual presentation of the procedure of performing tasks, monitoring worksheets; and association of ICT-mediated management of the educational process. Due to the involvement of individual expert participants in the training, the technology of increasing the activity of the activity takes place.

Automated incomes and facilities of cloud technologies appear as means of learning in a cloud-oriented environment (Microsoft Office 365: World, PowerPoint, Site, Blog, Excel, Excel-Forms, One Drive, One Note, Skype).

The result of training is: increasing the level of participants in the ICT educational process of competence, creating a cloud-oriented atmosphere for the formation of the professional position of a teacher, and improving the organization and results of scientific and pedagogical research, which become more accurate and concrete.

Possibilities of realizing the advantages of the latest technologies in research institutions.

To modernize and improve scientific-organizational and scientific activities in scientific research institutions, the implementation of modern technologies is necessary. The formation of the information society is largely determined and inextricably linked to the development and spread of innovative technologies: information and communication networks, web and cloud services, virtual reality technologies, mobile, adaptive technologies and tools, etc. The introduction of such technologies pays to the perfection of the efficiency of professional and informative activities, qualitative updating of data processing processes, and their interaction (Plakhotnik et al., 2023).

We consider the Google service (Google Apps) to be one of the most promising tools and the most accessible in this context. Google Apps is an important balanced package of cloud services, which is necessary for information technology support of interoperable work offered by Google Inc. Use can be on a paid basis, by subscription, or free of charge. Google Apps is a cloud solution, so all user data is not stored on the client's local servers, but distributed in secure and reliable data centers.

The use of Google Cloud services, with this approach, provides support for the scientific and organizational activities of a scientific research institution and scientific work and contributes to the implementation of scientific and pedagogical research, increasing the level of organization of scientific work, contributes to the implementation of the results of the work carried out, and also ensures an increase in the general level of IC-competence of sub-objects of the scientific research institution (heads of laboratories, departments, scientific correspondents, graduate students, scientific employees, doctoral students, interns, etc.) (Nosenko et al., 2016).

Support for the implementation of cloud technologies by the state policy of the countries of the European Union regarding the improvement of the qualifications of teachers and their quality training.

The countries of the European Union in the 21st century in their educational policy give an important place to the subject of the active mandatory use of cloud technologies in the system of higher education and the system of teacher training. The primary role in this process was given to the European Commission strategy "Unleashing the Potential of Cloud Computing in Europe" (Bosse et al., 2016). The active use of cloud technologies in the educational and scientific space encourages educational institutions to create a cloud-oriented educational and scientific environment, develop and approve normative documents regarding the creation of the expert position of educator, determine the priority ways of improving the teacher's qualifications and training specialists in pedagogical activity in this direction (Semenikhina et al., 2020).

In each country, the implementation of cloud technologies in the educational process is at different stages, the creation of a cloud-oriented educational and scientific environment for the formation of the professional position of a

teacher is always in the first place in the normative basis of the countries of the European Union, we note that in the state policy, the preparation and improvement of the teacher's qualifications in this direction, development of priority ways and improvement of the educational field is determined by them independently (Zhang, 2023).

Such specified features of training and retraining of future teachers-practitioners in the countries of the European Union will provide an opportunity to apply cloud technologies in the domestic educational space and to concentrate the best assets of foreign countries to create a cloud-oriented educational and scientific environment to form the professional position of a teacher (Khmil, 2020).
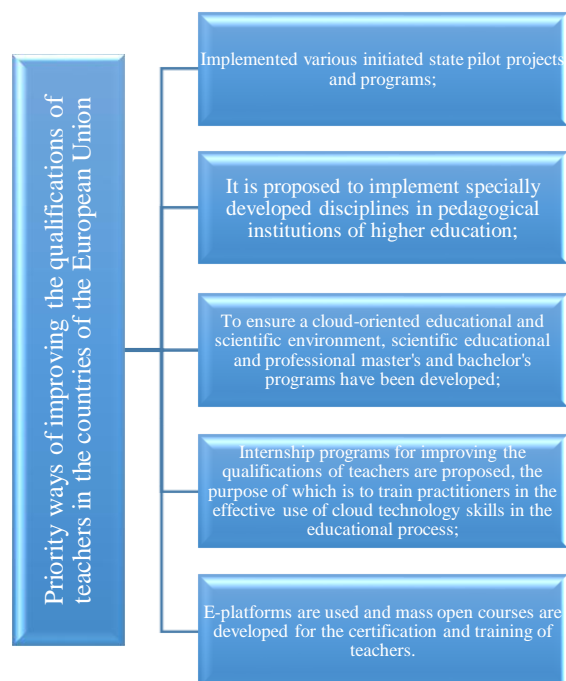

Figure 1. Priority ways of improving the qualifications of teachers in the countries of the European Union.

Peculiarities of training and retraining of future practicing teachers in the USA regarding the possibility of using cloud technologies in the educational space for the possibility of creating a cloud-oriented educational and scientific environment to form the professional position of the teacher.

Specialists of the US National Institute of Standards and Technology (NIST) consider cloud technologies (Cloud Computing) as a model of "convenient network access to the general fund of information resources, including data files, servers, networks, services, and software that can be quickly provided by conditions of minimal management effort or interaction with the supplier" (Mell & Grance, 2011).

Specialists of the US National Institute of Standards and Technologies (NIST) singled out the general properties of cloud services: homogeneity of the infrastructure; advanced security technologies; mass application; stability of calculations; application virtualization;

geographically distributed use; cheap software; service orientation (Nosenko & Voloshinska, 2016). Among the characteristics, the following are noted: free network access, self-service capabilities, fast elasticity (release of the resource at any time in the required amount), independence from the location of the resource, service measurability (payment is made upon the fact of providing services) (Shyshkina, 2015).

Specialists of the US National Institute of Standards and Technologies (NIST) singled out the most important categories related to the application of cloud technologies in the educational space for the possibility of creating a cloud-oriented educational and scientific environment to form the professional position of a teacher:

1. Software as a Service (SaaS) – delivers data via the Internet, remote management of the educational process, refers to any software;
2. Infrastructure as a service (IaaS), which is a model of providing resources on demand;

3. Platform as a service (PaaS), represents a set of application infrastructure services that are rented from the provider.

So, we can say that cloud technologies include a wide range of different services for the possibility of creating a cloud-oriented environment and widely used applications:

- for data storage (Box, Dropbox, iCloud, etc.) online solutions;
- mail services (such as Office mail Server, Gmail, or Yahoo!);
- other types of applications that may be available online (Crucial Cloud Hosting, 2014).

Ensuring the integration of all components of cloud technologies, with the aim of changes and innovations of all their components.

Cloud technologies in the narrow sense are defined as data processing technologies in which, as an online service, computer resources are provided to the user and involve the implementation of a set of techniques and operations that are carried out in a certain sequence in a certain way and are aimed at creating a cloud-oriented educational and scientific environment, effective and clear organization of pedagogical activity to form the professional position of the teacher and achieve the set goal.

Since the concept of "cloud technologies" fully corresponds to the concept of "educational technology", let's consider cloud technology, summarizing the above definitions, as a system of actions that are consistently performed by the subjects of the educational process, which are gradually implemented and allow to form a cloud-oriented educational and scientific environment with the aim formation of the teacher's professional position (Sayginer, 2023).

The construction of cloud technologies for a cloud-oriented didactic and methodical environment is built on the next provisions:

- the application of a personal approach in the formation of the professional position of a teacher, which provides opportunities for the use of interactive methods of education;
- following the model of competence of the teacher-practitioner, the development of educational programs for the formation of the professional position of a specialist using cloud technologies;

- flexibility of methods, content, and implementation of advanced technologies;
- reasonableness and interdependence of integration and differentiation of innovative elements, which is the basis of cloud technologies;
- the unity of target attitudes in the formation of the teacher's professional position, which ensures the process of implementation of cloud technology and involves all subjects of the educational process;
- systematic and continuous formation of the professional position of the teacher and at all stages of the professional formation of students and training themes of the didactic process, functioning of the technological process.

Therefore, when implementing and developing cloud technologies to form the professional position of a teacher, it is necessary to ensure the integration of all its components, taking into account the synergistic vision that changes in one of the components will lead to significant changes in other components.

Integrative functions of cloud technologies in the preparation and retraining of future pedagogues-practitioners in a cloud-oriented educational and scientific environment.

The following integration functions are important for the implementation of the possibility of using cloud technologies in the educational space in a cloud-oriented educational and scientific environment:

- the information function is the basis for creating an information base, which, in turn, is the basis for planning in the field of education to form the professional position of a teacher;
- the cognitive function ensures the formation of cognitive processes (thinking, attention, memory, imagination) in a cloud-oriented educational and scientific environment, and therefore promotes understanding, reflection, reproduction, and assimilation of educational material by teachers;
- the organizational and management function is manifested in the creation of a cloud-oriented educational and scientific environment, which is the result of planning the optimal, most favorable conditions for management and rational organization of the learning process;
- the control function involves systematic monitoring in a cloud-oriented educational and scientific environment, contributes to

the valuation of the superiority of ensuring instructive achievements and forming the teacher's professional position on this basis, and provides rational pedagogical influences to correct or stimulate knowledge.

Therefore, the use of cloud technologies in a cloud-oriented educational and scientific environment in the training of specialists in a higher education institution and the retraining of personnel allows to increase in the administrative, cognitive, informational, and control components of the training process (Danysko & Kornosenko, 2019).

The factors of the formation of a cloud-oriented environment and the principles of the formation of a cloud-oriented educational and scientific environment contribute to the formation of the professional position of the teacher.
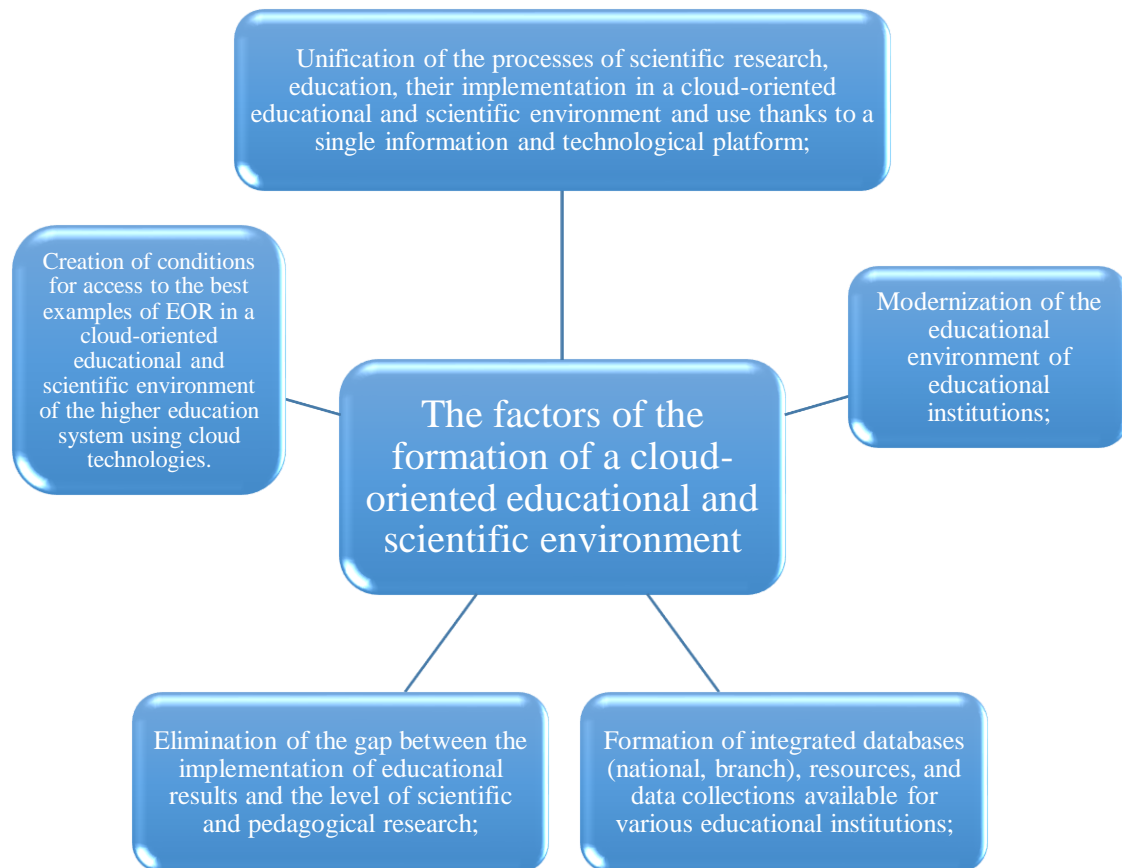

Figure 2. The factors of the formation of a cloud-oriented educational and scientific environment.
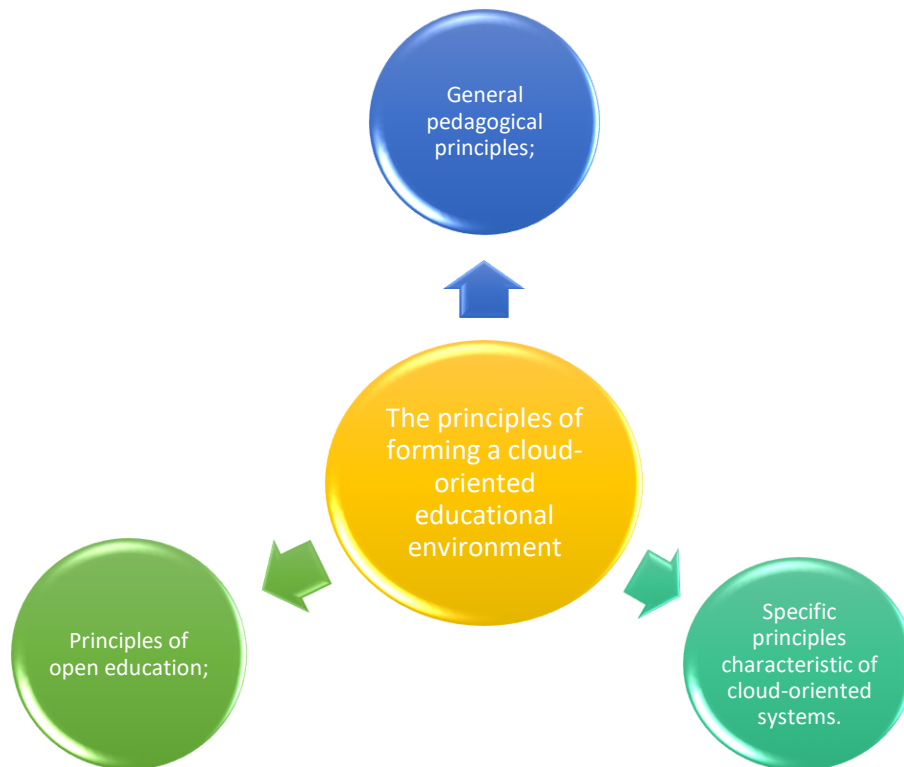
Figure 3. The principles of forming a cloud-oriented educational environment (Nosenko et al., 2016).

Experimental verification of the effectiveness of the ways of using a cloud-oriented educational and scientific environment for the formation of the teacher's professional position.

Having clarified the mandatory methods, procedures, and incomes of learning in a cloud-oriented environment; revealing the possibilities of realizing the advantages of the latest technologies in research institutions; having studied the peculiarities of the introduction of cloud technologies by the state policy of the countries of the European Union and the USA regarding the possibility of using cloud technologies in the educational space to form the professional position of the teacher; having singled out the ways of ensuring the integration of all components of cloud technologies, with the aim of changes and innovations of all their components, we found out the main integration functions, factors, and principles of cloud technologies in the preparation and retraining of future teachers-practitioners. This work allowed us to conduct a study that contributed to the development, substantiation, and experimental verification of ways of using a cloud-oriented educational environment of the qualified position of a teacher.

The training and retraining of higher school teachers for the use of cloud services in a cloud-oriented educational and scientific environment of the teacher's qualified position was carried out in three stages.

In the first stage, we offered the training "Designing a cloud-oriented educational environment" for which 8 hours were allocated. The task of every administrator of a higher education institution was to create a cloud-oriented environment of an educational institution, and the teacher had to create his own educational environment. When conducting the training, we set the goal: of improving the skills of working with certain services in a cloud-oriented educational and scientific environment for the formation of the professional position of a teacher and solving problematic issues that arose in the practical activity of a specialist during the use of services.

In the second stage, respondents were offered a course on intensive use of services as part of summer training, with a volume of 40 hours (during the summer vacation). The result of this stage was the development of a group project where teachers received unlimited communication with colleagues, had the opportunity not only to combine the development

of IC-competencies but also to get acquainted with the latest innovations in the IT industry, to organize joint work on projects, to improve pedagogical skills while using services for the formation professional position. Free access to the Internet and the availability of a gadget (tablet, laptop, etc.).

In the third stage, during the seminar, the respondents presented their best practical solutions for using cloud services for educational purposes to form the professional position of a teacher.

Students in classes preferred the following cloud technologies and cloud platforms.

Cloud technologies:

1) use of Office Web Apps;
2) electronic journals and diaries;
3) online services for the educational process, communication, and testing;
4) distance learning systems, library, media library;
5) file storage, sharing;
6) joint work;
7) video conferences;
8) e-mail with the gymnasium domain.

Cloud platforms.

The Google Apps Education Edition cloud platform provides the following services: Google Calendar, Gmail email, Google Drive, Google Sites, Google Drive, and Google Docs.

Google Drive is a repository for storing your own files and the ability to configure access rights to them.

Google Docs is a service for creating documents, tables, and presentations with the possibility of granting shared access rights to several users.

Convenience and versatility of access are ensured by the wide availability of services.

In the "cloud" you can create folders and documents, use a text editor (Word), a spreadsheet (Excel), a presentation editor (PowerPoint), and a survey editor (forms).

To master new services, a teacher needs constant professional development in ICT issues in connection with their constant development and progress.

During the proposed educational seminar in a cloud-oriented educational and scientific environment, future specialists had the opportunity to learn about the practical application of cloud services and their theoretical foundations. They were offered practical work using several services to improve the educational process to form a professional position or organize cooperation education seekers.

As a result of the experiment, we observe an increase in the level of IC competence of future specialists, which is possible in a cloud-oriented educational and scientific environment and is a necessary condition for the formation of the professional position of a teacher.

In particular:

– teachers' understanding of the importance and necessity for the formation of the professional position of future cloud service specialists in a cloud-oriented educational and scientific environment increased by 43%;
– the practice of cloud facilities by teachers in their expert doings increased by 48%;
– the basic knowledge about the possibilities of cloud services increased by 47%;
– the ability to collaborate with the help of cloud services in a cloud-oriented educational and scientific environment increased by 45%;
– with the support of cloud facilities, the use of various forms of educational activity to form the professional position of a teacher increased by 47%;
– for the formation of the professional position of the teacher in the training of students of higher education, the use of basic services increased by 48%.

Therefore, the training of teachers in new information technologies, during the formation of the professional position of a teacher in a cloud-oriented educational and scientific environment, made it possible to determine that: specialists are actively improving their qualifications in the field of ICT; there are no problems with missing devices; systematic training in three stages gives significant results in the development of an individual's intellectual competence during the formation of the professional position of a teacher; cloud services become an effective tool of a higher school during the organization of cooperation and joint work between teachers and students of education.

The average and sufficient level of IC-competence of future specialists during the formation of the professional position of a teacher allows for the wide use of cloud services for various types of activities, namely in the organization of "inverted learning", the organization in a cloud-oriented educational and scientific environment of group work of education seekers, joint work on projects; conducting web quests. Therefore, cloud services in a cloud-oriented educational environment become a tool for a modern teacher for the formation of his professional position (Lytvynova, 2016).

Recommendations for the practice of cloud services in the formation of the teacher's qualified position.

We recommend several directions of application of cloud services in shaping the professional position of future experts in the context of their training and retraining, which combines electronic and traditional components with the help of the G Suite for Education cloud educational platform.

1. Instrumental equipment for the creation of the qualified position of an educator for the creation of electronic educational materials in a cloud-oriented educational position (a disk for storing information, documents, tables, presentations, photo and audio banks, video editors, geoservices, virtual trips, etc. – Google Drive, Google Docs, Google Sheets, Google Slides, Google Photos, YouTube, Google Maps, Google Expeditions, etc.).
2. Services for placing materials in a cloud-oriented educational and scientific setting and accounting for the activities of students of education (sites, e-mail, blogs, network diaries, calendar, virtual room, survey forms – Gmail, Google Blogger, Google Sites, Google Forms, Google Calendar, Google Classroom, etc.).
3. Services for interactive interaction of participants in the educational process (webinars, chats, forums, social networks – Hangouts, Gmail, Google+, etc.).

The Google Classroom cloud cyber room is an important service of the G Suite for Education platform. It easily integrates interactive tools for the formation of the teacher's professional position, to support the teaching and learning of third-party developers (mind maps, interactive exercises, electronic notebooks, virtual boards, etc.), harmoniously integrates Google applications, and basic services. The Google Classroom cloud cyber room provides an opportunity to generate grades according to any assessment standards, monitor the level of participation of students in the discussion of tasks, and appoint new teachers.

Important cloud services should be used in a cloud-oriented educational and scientific environment for the formation of the professional position of a teacher.

Cloud office technologies. A large group is represented by systems for processing and creating presentations, spreadsheets, and word processors, graphic programs.

The following cloud services belong to this group:

– text – Word Online, Google Documents, Zoho, Personal Office (office.heapnote.com), Writer ONLYOFFICE, Ond Note, etc.;
– spreadsheets – Excel Online, Google Sheets, Office (office.heapnote.com), Online Office Apps, ONLYOFFICE Personal, Tools, etc.;
– presentational – Google Presentations, PowerPoint Online, Prezi, PowToon, Knovio, Google Presentations, Piktochart, etc.;
– graphics – Piktochart, Google Images, Cacoo, Vizualize.me, etc. These cloud services allow you to edit and create dynamic and static graphs, drawings, charts, etc.

With their help, it is easy not only to create textbooks, joint documents, study guides, interactive posters, and electronic worksheets, but also to organize educational projects: both individual and group, track, and comment on the changes made, and be able to determine the activity of the student in completing the task.

Cloud video services. The use and development of educational video materials is of particular importance in working in a cloud-oriented instructive environment for the development of the qualified position of a teacher, since the technological base of the educational sphere is constantly updated. Improving the work of a future specialist involves constant updating in a cloud-oriented educational and scientific environment and systematization of information regarding the formation of his professional position. The implementation of these tasks is facilitated by the use and creation of video lectures, and educational videos posted on the

Internet. In practical activities, it is worth using the capabilities of the YouTube cloud service to form the professional position of a teacher who provides services for viewing, placing, and organizing video materials by users on the Internet. The ability to select and save educational videos, and video lectures lets you ensure the use of the principles of accessibility, clarity, the method of demonstration and illustration of professional exercises, technical elements, etc. in a cloud-oriented educational and scientific environment.

Social services. Modern technologies are not only informational in a cloud-oriented educational environment, but also communicative, which involves the formation of a teacher's professional position not just viewing or consumption of certain electronic content, but also the interaction of participants, its creation and updating. Web 2.0 technologies (Wiki, sites, word clouds, blogs, games, interactive boards, crosswords, presentations, mind maps, etc.) are based on the principle of "collective authorship".

Knowledge control services. Popular among students in a cloud-oriented educational and scientific environment is the Learningapps.org service, which was created for interactive exercises of various types and contains more than 14 different templates: puzzles, crosswords, test tasks, time tape, and sorting quizzes of various types. The created tasks and exercises involve group work and individual performance of tasks.

We offer this service for use in a cloud-oriented educational and scientific environment mainly to increase the motivation of future teachers for the learning process, and formative evaluation of the activation of cognitive activity in the formation of the professional position of the teacher.

The use of cloud technologies in the system of higher education of future specialists creates prerequisites for the organization of personalized training, collective teaching, and improvement of interactive forms of training, which affects the improvement of the quality of the educational process (Danysko & Kornosenko, 2019).

Conclusions

Cloud technology is a data processing model that provides convenient, affordable, ubiquitous network access to servers, shared resource storage, applications, and services, etc. The creation of a cloud-oriented educational and scientific environment provides a flexible method to see the educational requests of education seekers and provides an opportunity to quickly update informational material.

We have clarified the compulsory approaches, systems, and resources of education in a cloud-oriented environment; the possibilities of realizing the advantages of the latest technologies in research institutions are revealed; studied the peculiarities of the introduction of cloud technologies in the countries of the European Union and the USA.

In the process of research, we identified ways to ensure the integration of all components of cloud technologies. With the aim of changes and innovations of all their components, we singled out the main integration functions, factors, and principles of cloud technologies in the preparation and retraining of future pedagogues-practitioners in a cloud-oriented educational and scientific environment. This work allowed us to conduct a study that contributed to the development, substantiation, and experimental verification of ways of using a cloud-oriented environment for the formation of the professional position of a teacher.

The disadvantages of using cloud technologies are as follows: a high-quality Internet connection is required to work in the cloud; the dependence of data security in the cloud on the provider providing the service; there is no full control over user data posted on online sites; there is no physical access to the data hosted in the service provider's cloud.

As a result of the experimental work, we observe an increase in the level of IC-competence of teachers, which is possible in a cloud-oriented educational and scientific environment and is a necessary condition for the formation of the professional position of a teacher.

We have offered recommendations when forming the professional position of a teacher. It was concluded that cloud services are important for education and should be used in a cloud-oriented educational and scientific environment for the formation of the teacher's professional position.

Approaches, systems, and resources of learning in a cloud-oriented environment require further study.

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