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## THEORETICAL SUBSTANTIATED OF THE PEDAGOGICAL SYSTEM MODEL FOR FORMING THE PROFESSIONAL READINESS OF FUTURE TEACHERS TO USE CLOUD TECHNOLOGIES IN THE EDUCATIONAL PROCESS

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The article specifies the concepts of «system», «pedagogical system», «model». Based on methodical approaches (systemic, synergistic, person-oriented, activity, competence, informational and environmental) a theoretical substantiation of the pedagogical system model for forming the professional readiness of future teachers to use cloud technologies in the educational process. Its structural components are characterized as target (goal, tasks, methodological approaches, and principles), substantive (learning content, areas of work for adequate preparation of future teachers for the use of cloud technologies in the educational process), technological (forms, methods, teaching tools, phasing formation of professional readiness), subject-object (subject - teachers of higher education institutions, object - students of higher education, their interaction, subject-subject relations) and environmental (cloud-oriented educational an information environment for training future teachers to use cloud technologies in the educational process). It was determined the professional training of future teachers for using cloud technologies in the educational process has five components: social-humanitarian, psychological-pedagogical, information-technological, systematic, and practical. And a special environment should implement a relationship of four components: program-methodical, communication-control, result-corrective, and technological. The proposed model of future teacher training has been improved following the requirements of the information society and the needs of general secondary education institutions in highly qualified teachers with a formed readiness to use modern ICT in the educational process, in particular cloud-based. The author assures that under such a system, it is possible to ensure the implementation of innovative approaches to the digitalization of the educational process of secondary education institutions. On the other hand, to provide a competence-oriented process of training future teachers.

***Keywords:*** modell, pedagogical system, formation of professional readiness of future teachers, use of cloud technologies in the educational process.

***Наталія Хміль «Теоретичне обґрунтування моделі педагогічної системи формування професійної готовності майбутніх учителів до використання хмарних технологій в освітньому процесі».***

У статті уточнено поняття «система», «педагогічна система», «модель». На основі методичних підходів (системному, синергетичному, діяльнісному, компетентнісному, інформаційно-середовищному) здійснено теоретичне обґрунтуваннямоделі педагогічної системи формування професійної готовності майбутніх учителів до використання хмарних технологій в освітньому процесі. Схарактеризовано її структурні компоненти: цільовий (мета, завдання, методологічні підходи та принципи), змістовий (зміст навчання, напрями роботи для ефективної підготовки майбутніх учителів до використання хмарних технологій в освітньому процесі), технологічний (форми, методи, засоби навчання, етапність формування професійної готовності), суб’єкт-об’єктний (суб’єкт – викладачі закладів вищої освіти, об’єкт – здобувачі вищої освіти, їх взаємодія, суб’єкт-суб’єктні стосунки) та середовищний (навчально-інформаційне середовище

для підготовки майбутніх учителів до використання хмарних технологій в освітньому процесі). Визначено, що професійна підготовка майбутніх учителів ло використання хмарних технологій має такі компоненти, як: соціально-гуманітарний, психолого-педагогічний, інформаційно-технологічний, системний, практичний. А спеціальне середовище має реалізовувати взаємозв'язок таких компонентів: програмно-методичного, комунікаційно-контролюючого, результатно-коригувального та технологічного. Запропонована модель підготовки майбутнього вчителя вдосконалена з урахуванням вимог інформаційного суспільства та потреб закладів загальної середньої освіти у висококваліфікованих педагогах із сформованою готовністю до використання сучасних ІКТ в освітньому процесі, зокрема хмарних. Авторка переконує, що за такої системи можливо, із одного боку, забезпечити впровадження інноваційних підходів до цифровізації освітнього процесу закладів загальної середньої освіти, із іншого – забезпечити компетентнісно орієнтований процес підготовки майбутніх учителів.

***Ключові слова*:** модель, педагогічна система, формування професійної готовності майбутніх учителів, використання хмарних технологій в освітньому процесі.

**Relevance of research**. The problem of active implementation of modern information technologies in the educational sector is complex and multifaceted. Its solution is only possible under the condition of the appropriate role of the contemporary teacher in the specified context.

At the same time «the development of digital educational technologies is accompanied by more and more new challenges that need to be addressed in a timely and quality manner» [4, p. 338].

G. Ponomaryova rightly noticed that «the leading idea is the idea that modern socio-economic, political and spiritual development of society requires not only highly educated, competent specialist, but also, above all, highly cultured upbrought, spiritual, humane personality, able to un-derstand other people, to express honor and esteem,self-actualization and fulfillment in good deeds» [15, p. 326].

In the opinion of A. Kharkivska and A. Malykhina «in modern conditions of innovative development of our State the fundamental change of educational paradigm exists. An educational establishment must not only give professional knowledge, but also form the variety of professionally

relevant and socially important personal qualities (competencies) that describe the social portrait of the future specialist, contribute toward successful employment and further professional and personal growth ofgraduates.The main task of higher educational establishments is to improve the quality of education according to modern and prospective implementation of competence approach» [3, p. 2 ].

A. Prokopenko says that «with the development of information and communication technology requirements of process automation is constantly increasing, because they are aimed at solving many problems, namely: digitization of paper documents; increases the speed of data retrieval; elimination of full or partial loss of information, inability to delay during data transfer from the server to the user, and the like» [17, p. 98].

The urgency of the problem of preparing future teachers for the use of cloud technologies in the educational process, as well as the need to solve it not only at the scientific-theoretical but also at the methodological and practical levels, prompts us to develop and characterize a model of a pedagogical system for the formation of the professional readiness of relevant specialists for the above activities.

**Analysis of recent research and publications**. It should be noted that «the developing ideas about the profession of «teacher» in pedagogical science and practice have an impact not only on teacher education, but also on non-pedagogical areas of professional education. It opensup new perspectives in constructing the theory and methodology of vocational education and determines the directions for studying the problem of the development of teacher education» [2, p. 230].

Recently, there has been increasing attention to the problem of training future teachers to use cloud technologies in the educational process. In particular, the technological aspects of the implementation of cloud technologies and the possibilities of their use in the educational process are substantiated (V. Bykov, O. Kuzminska, S. Lytvynova, N. Morze, S. Semerikov, O. Spirin,

M. Shyshkina, etc.); the possibilities of using cloud technologies in the professional training of future teachers (T. Arkhipova, T. Zaitseva, M. Zolochevska, O. Kuchai, N. Morze, N. Soroko, M. Shynenko, etc.); formation of prospective teachers (primary school, mathematics, informatics) competencies that determine their readiness to use cloud technologies in the educational process (N. Bakhmat, T. Vakaliuk, M. Popel, V. Proshkin, N. Stetsenko, H. Tkachuk, etc.); the method of designing various cloud-oriented educational environments, in particular the training of future teachers (primary school, informatics, and mathematics) (N. Bakhmat, T. Vakaliuk, O. Korotun, V. Oleksiuk, M. Rasovytska, A. Striuk, etc.). At the same time, despite enough studies mentioned above, the problem of forming the professional readiness of future teachers to use cloud technologies in the educational process as a system remains relevant and requires further resolution at the theoretical and methodological levels.

**The purpose of the article** is to theoretically substantiate the model of the pedagogical system for the formation of professional readiness of future teachers for the use of cloud technologies in the educational process.

**Presentation of the main material**. According to the results of the theoretical analysis of the psychological and pedagogical literature on the theory of pedagogical systems (S. Arkhanhelskyi, T. Ilina, N. Kuzmyna, V. Sadovskyi, A. Uiomov etc.), it was clarified that the creation of pedagogical systems is connected with the use of a systemic approach, that is, taking into account the minimum set of characteristics of the system: composition (a set of elements that are its components), structure (the relationship between them) and the functions of each of the elements, its role and value in the system.

The main category of system research is the Concept of «system». The conducted analysis of the scientific literature gives reasons to state that, from the point of view of scientists, the Concept of «system» correlates with the Concept of «complexity» (V. Afanasiev), «complexity of elements» (R. Hiliarevskyi, O. Mykhailov, O. Chornyi), «set interconnected elements» (T. Ilina), «component» (V. Tiukhtin). Therefore, in our study, we will understand

the system as the presence of elements of a certain kind that are interconnected and interact with each other and form unquestionable integrity and unity.

The researchers single out the the following features of the system: the diversity of elements, their unity, connection, interaction, and integrity [7, p. 31].

V. Ortynskyi draws attention to the importance of the set of relationships and interconnections between the components of the system; he notes that thanks to this, the system acquires new integrative qualities: flexibility, dynamism, variability, adaptability, stability, predictability, continuity, democracy [12, p. 21].

Based on the opinion of I. Malafiik, it is possible to distinguish this system from other objects and systems based on the presence of new indicators and properties. Knowledge of the fundamentals and understanding of its parts occur at the same time. We cognize the whole «not as isolated phenomena, taken by themselves, but as parts of the whole. Knowing the whole, we immediately separate its parts. Without parts, there is no whole; without the whole, there are no parts, which means that the whole is an indivisible unity, integrity» [11, p. 17–18].

The integrity of the system, believe that the system can be understood as something integral, contrast society with the environment. The dismemberment of the system suggests the concept of «element» – a unit whose properties and functions are determined by its place within the framework of the whole, and to some extent, the properties of the entire mutually determine them.

The idea of the integrity of the system is specified by the presence of connections that can be called system-forming and the totality of which and their typological characteristics lead to the Concept of the structure and organization of the system. Most researchers use the structure and organization of the system to express its orderliness.

So, relying on the essential features, properties of the system and system principles of integrity, structure, functionality, hierarchy, development, and final goal, we can recognize the formation of the professional readiness of future

teachers for the use of cloud technologies in the educational process by the system, since it has the following features: the goal, defined structure, integrity, system-forming connections, hierarchy, functional characteristics, predictability, openness. Concurrent it is a pedagogical system. Let's justify the above. To do this, we will define the essence of the concept of «pedagogical system» and the features characteristic of a pedagogical system.

First, let's say that «pedagogical education is an integrative, open, developing systemthat includes a network of educational institutions of a pedagogical profile, a variety of successive educational programs that differ in their focus and level, built on the basis of state educational standards, and governing bodies. At the same time, pedagogical education is also a non-linear, variable process focused on the training of teachers capable of high-quality implementation and development of professional pedagogical activity not only in the traditional role of a teacher, but also in a much broader professional sphere «man-society-man» [2, p. 228].

In scientific circulation, this concept was first introduced by N. Kuzmina, considering it as a set of interconnected structural and functional components subordinated to the purpose of upbringing, education, and training of the young generation and adults. It considers the pedagogical system as a set of the following structural components: pedagogical goal (what to teach); educational and scientific information (what to learn); means of pedagogical communication (how to guide); students and teacher. The scientist believes that «the specified components are necessary and sufficient for creating a pedagogical system. There is no system when removing any of them». N. Kuzminoi's statement that each of the structural components of the pedagogical system affects the environment, and the system as a whole acts on the environment, organizing it about its own goal, is valuable for our research.

The pedagogical system a closed structure with a corresponding function given by a social order. He defines the pedagogical system as a particular set of interconnected means, methods, and processes necessary to create

an organized, purposeful pedagogical influence on forming a personality with given qualities. The scientist emphasizes that the more clearly structured the system is, the more precisely its function is specified and the more appropriate the implementation of the social order.

No less interesting is the concept of the pedagogical system of O. Kovalova, which he defines as a set of components, the interaction of which determines a high level of organization of the learning process, which is manifested in an increase in the level of its effectiveness.

The scientist singles out the following components of the pedagogical system: a set of people involved in education; experience and knowledge accumulated by society; set of semiotic structures, due to which information is encoded and accumulated; a collection of people who make knowledge available; management components, which include:

a) a set of «filters» (programs, textbooks, manuals, etc.);

b) ways of achieving the goal: means, forms, and methods of pedagogical influence;

c) teachers who perform several specific functions.

The pedagogical system as a socially conditioned integrity of interactions based on cooperation between themselves, the surrounding world, and the spiritual and material values of the participants in the pedagogical process, aimed at the formation and development of the individual.

From O. Sydorkin's point of view, the essence of the pedagogical system is not in the correlation between the content and form of people's activity but in the correlation of this activity in general with the pedagogical result [20, p. 70].

That the structure of the pedagogical system contains the following elements: the goal and content of education, methods, means, forms of organization of education and training, and teachers and students, which are interconnected. That the main system-forming element of the pedagogical system is the goal, and students are the main subjects.

L. Viktorova considers the pedagogical system as an ordered set of interconnected components that form a coherent unity, subordinated to the goal of education and training [12]. Among the members of the pedagogical system, she considers the result of education to be significant. The pedagogical system model schematically shows the environment surrounding the system, but it does not consider it as a separate component in the future.

Having analysed various approaches to the concept and construction of a pedagogical system, we note that a pedagogical system is understood as an ordered collection of interrelated and mutually determined learning goals, content, methods, forms, and means of planning and conducting, controlling, analysing, adjusting the educational process, aimed at raising the level effectiveness of student learning. The structure of the pedagogical system was supplemented with the following structural components: effectiveness since the criterion of the system's effectiveness can only be the level of success. Functional features include corrective and regulatory elements – correcting intermediate deviations of previous results from the partial goal and variations of the result from the initial goal. It is worth noting that these components are different in meaning, content, and functional purpose, so they cannot coexist in the system as one active element.

Therefore, based on the above, we note that the system of forming the professional readiness of future teachers for the use of cloud technologies in the educational process is a pedagogical system, which will be defined as an ordered set of interconnected and mutually conditioned components, united by a common purpose of functioning and aimed at achieving a particular result (increasing the level of professional readiness of the future teacher), acting as a whole.

By the components of the system, we will understand only those structural parts of it that are in constant interaction with other structural units within the limits of a particular integral system, the interaction of which determines the definition of qualitative features characteristic of the whole [18, p. 242].

Therefore, in understanding the problem of professional training of future teachers for the use of cloud technologies in the educational process, a systematic approach is fundamental, in the implementation of which it is possible to consider this process as a system by determining its structural components, system-forming connections, and functions.

It is worth noting that the professional readiness of future teachers to use cloud technologies in the educational process is defined as the individual state of the subjects, which prompts them to productively use these technologies in the educational process, which is manifested by a positive attitude, interest, and desire; possession of a set of theoretical knowledge, practical skills, and abilities; developed ability to self-assess one's professional level and awareness of the need for further professional growth in the specified activity.

Continuing the research, we consider it necessary to justify a set of theoretical propositions, the basis of which is the methodological foundations of our study.

The first provision is that the relevance and necessity of a systematic review and organization of the process of forming the professional readiness of future teachers to use cloud technologies in the educational process stimulate the elimination of the discrepancy between the need for competitive teachers who can innovatively organize the educational process using the capabilities of cloud technologies and the lack of an appropriate system of training future teachers for this area of professional activity.

By the second provision of the formation of professional readiness of future teachers for the use of cloud technologies in the educational process, we consider it as a pedagogical system, the components of which are: purpose, the content of professional training, forms, methods, means and technologies of education, subject (teachers of a higher education institution), object (students of higher pedagogical education), interaction and relations between them subject-subject, cloud-oriented educational and informational environment.

Due to the following provision, based on the methodological approaches

on which the research is based (systemic, synergistic, person-oriented, activity, competence, informational and environmental), it is possible to ensure the formation of professional readiness of future teachers for the use of cloud technologies in the educational process as a goal and result of research and experimentation work. Thus, the *systematic approach* ensures the systematicity of the process of forming the professional readiness of future teachers for the use of cloud technologies in the educational process; the *synergistic approach* ensures the openness of the pedagogical system, in which the student and the process of his education at the institution of higher education, as its essential components, are complex self-organized systems capable of non-linear development, «allows, in particular, to implement humanistic ideas in educational activities and to balance humanitarian outlook with nature-scientific one harmonious-ly» [15, p. 324]; *person-oriented and activity-oriented* – allows the student's personality to be considered as a subject of activity taking into account his individual characteristics, abilities, interests and needs; *competence-oriented* – directs the process of professional training of future teachers to a specific result – the formation of the student's abilities to successfully use cloud technologies in the educational process; *contextual* – provides modelling of the subject content of professional activity in the process of preparing students for the use of cloud technologies in the educational process; *informational* – ensures the formation of the cognitive component of the process of professional training of future teachers for the benefit of cloud technologies in the educational process; *environmental* – ensures the process of forming the professional readiness of future teachers in a cloud-oriented educational and informational environment.

According to the fourth provision, the professional training of future teachers for using cloud technologies in the educational process is end-to-end. It is carried out throughout the entire study period at a higher education institution using cloud technologies. With their integration into the educational process, it is possible to ensure changes in the methods of academic activity, and the development of subject-subject relationships will be promoted. It is possible to

form an active and proactive position in education because «the theoretical basis of research of students' education is the study of the spir-itual life of society and its values; psychological theory of personalityand relation-ships; specially organized activities and communication of the personality, one's self-identity; development of spiritual abilities; acmeology» [15, p. 324].

In our opinion, «the modern student is well versed in the possibilities of his own personality and multimodal world. He can improve himself and develop if provided with appropriate tools and educational conditions: easy access to resources, opportunities for didactic choice, obtaining technologies and consultations that would help him self-determine and practically self-fulfil in the world full of information entropy. In this light, the assessment of modern methods and technologies of personality-oriented approach by direct participants in the educational process – students and teachers – seems interesting» [16, p. 3].

The following provision is that practical experience in applying cloud technologies in the educational process is acquired within the framework of contextual learning. The reproduction of real connections and relationships in the context of their future professional activities is expected in the methods and forms of students' educational activities.

The final, sixth provision is the need to design a cloud-oriented educational and informational environment, which significantly affects the organizational forms and methods of training future teachers to use cloud technologies in the educational process.

Continuing, we note that the creation of a pedagogical system for the formation of professional readiness of future teachers for the use of cloud technologies is based on the following:

– system principles (integrity, structuralist, hierarchical structure, diversity of system description, consistency);

– principles of professional education (professional-pedagogical orientation of the integral educational process in the institution of higher education, conformity to nature, humanistic orientation of professional training, integrity of

the pedagogical process, individualization, and differentiation);

– general didactic principles (directing education towards the fulfilment of educational tasks and general development of students, scientificity, continuity, visualization, a combination of various methods and forms of education, modularity, integration, problem-solving);

– specific principles (the principle of interactivity in the educational process, the optimal combination of individual and group work, the principle of concentricity, the principle of orientation towards the development of independence in the use of cloud technologies in the educational process, the principle of activation of educational and cognitive activities, activities using cloud technologies, the principle of their use in the process of professional training, the principle of pedagogical expediency of their use).

So, substantiated theoretical propositions, determined, and characterized methodological approaches and principles, and defined the essence of professional readiness of future teachers for the use of cloud technologies in the educational process are the theoretical basis for developing a model of the pedagogical system for the formation of professional readiness of future teachers for the use of cloud technologies in the educational process.

Analysis of scientific studies by V. Bezpalka, L. Viktorovoi, V. Volodka, R. Horokhovoi, O. Dubaseniuk, O. Kovalova, N. Kuzmynoi, etc., who devoted their research to the modelling of pedagogical systems, emphasize the importance of using the modelling method in pedagogical research, which involves the creation of models of research objects.

In the pedagogical dictionary, «model» (from the Latin «*modulu*s» – measure, sample) is defined as a system of objects or signs that reproduces some essential properties of the original and can replace it in such a way that its study makes it possible to obtain new information about this object. According to another definition (Z. Riabova), a model is a description of the object of research (subject, phenomenon, or process) in any formalized language, compiled to study its properties [19]. Considering the above definitions and the purpose of our

research, the model will be understood as a formalized description of the properties of the process of forming the professional readiness of future teachers to use cloud technologies in the educational process, the study of which will allow obtaining new information about it and determining pedagogical measures that ensure its effectiveness and efficiency.

Studying the preparation of students for professional pedagogical activity, O. Dubaseniuk emphasizes that modelling this process contributes to its improvement and improves the quality of pedagogical education. Therefore, we consider it necessary to determine the essence of the definition of «modelling».

In the pedagogical dictionary, modelling is interpreted as the construction of copies, models of pedagogical materials, phenomena, and processes; visual and figurative description of methods and phenomena studied with the help of diagrams, drawings, concise verbal characteristics, and explanations [19, p. 184].

The analysis of the scientists' works allowed us to conclude that in the pedagogical literature, there are several approaches to determining the essence of modeling depending on the aspects of its consideration. In particular, regarding the content of training and educational activity, it is possible to consider modelling the scope of movement (as an apparatus for teaching a specific discipline or a learning tool for determining the content of training material) or the training process (as a pedagogical technique, a system of methods and forms of training). H. Matushynskyi and A. Frolov believe that modelling allows combining an experiment with constructing logical structures and scientific abstractions in studying a pedagogical object/ This, according to Yu. Shaprana makes it possible to analyse and evaluate the main stages of the educational process, its elements, and the behavior of subjects.

The use of the modelling method in our research is aimed at building a model of the pedagogical system of forming the professional readiness of future teachers for the benefit of cloud technologies in the educational process, which involves defining goals and objectives; the content of students' academic activities;

methods, forms, and means of its organization; subjects of the educational process; an environment of the educational process, which provides for active interaction; results of educational activities. By modelling the appropriate pedagogical system, we managed to find out the definitions of the concepts of its structural components and connections that will influence their development.

So, based on the studies mentioned above of scientists, we identified the following structural components of the pedagogical system of forming the professional readiness of future teachers to use cloud technologies in the educational process: target (purpose, task, methodological approaches, principles), substantive (the content of training), technological (forms, methods, means of education, phasing of formation of professional readiness), subject-object (subject (teacher), object (student of higher education), interaction and relations between them are subject-subject) and environmental (a cloud-oriented educational and informational environment).

We describe the structural components of the pedagogical system that we have determined.

The *target component* reflects the orientations of modern society for the training of competent teachers for the active initiation of state programs, the implementation of which involves the dynamic introduction of cloud technologies in the educational process.

The social order, which is the basis of the system of training a future teacher capable of using cloud technologies in the educational process, is taken into account in the provisions of domestic legal documents, which reflect the main requirements for teacher training («Law on Higher Education», «National Strategy for the Development of Education in to Ukraine for the period until 2021», Concept of implementation of state policy in the field of general secondary education reform «New Ukrainian school», «Concept of development of pedagogical education») and directions of state policy in the area of informatization of education (Law of Ukraine «On the National Informatization Program», «Strategy for the development of the information society in Ukraine for

2013-2020», Concept for the development of the digital economy and society of Ukraine for 2018-2020, the Project «Conceptual foundations of the development of electronic education in Ukraine», the Project «Cloud technologies in education») and foreign regulatory documents («DigComp 2.0», «DigCompEdu», etc.). Based on these documents, it is possible to determine the pedagogical goals of the pedagogical system of forming the professional readiness of future teachers for using cloud technologies in the educational process: strategic goals, tactical and operational goals.

Ye. Khrykov, A. Kharkivska, H. Ponomarova and A. Uchitel draw attention that «digitization caused not only the emergence of fundamentally new mechanisms of administration, new content of management activity, but also changed the very essence of public management» [9, p. 237].

Following the above-mentioned legal documents of the active implementation of cloud technologies as means designed to promote the accessibility of education, the activation of educational and cognitive activities, and the organization of joint activities in the virtual space, it is essential to train a competitive teachers who has modern information technologies, in particular cloud ones, and is ready to apply them in the educational process for the comprehensive development of the student's personality. Given such judgments, the main *strategic goal* of our proposed pedagogical system should be the formation of the professional readiness of future teachers for the use of cloud technologies in the educational process.

The *tactical goal* reflects the integrity of the formation of the components of the professional readiness of future teachers for the use of cloud technologies in the educational process, namely*:*

1. Formation of motives, interests, desires, and value attitudes towards using cloud technologies in the educational process (motivational and value component).

2. Formation of a system of theoretical knowledge (psychological-pedagogical, subject, instrumental-technological, and systematic) necessary

for the organization of the educational process using cloud technologies and the development of skills for the independent acquisition of knowledge (the cognitive component).

3. Development of students' abilities and skills in the conscious use of cloud technologies for the effective performance of certain tasks in the educational process; expansion of creative potential in this area of pedagogical activity (operational component).

4. Formation of the ability to self-assess one's readiness to use the opportunities of cloud technologies in the educational process, encouraging students to improve themselves in this direction (reflexive and prognostic component).

5. The implementation of this level will be carried out in three stages: primary, information-technological, and quasi-professional.

The *primary stage's goal* is to form cognitive motives and interest in cloud technologies and their use in the educational process. At this stage, the systematization and deepening of the computer knowledge acquired in the process of general education are envisaged for improvement of basic skills of working with cloud technologies, encouragement to self-evaluate one's actions, and the process of acquiring a system of knowledge and developing self-control skills. This stage is fundamental, on which the rest is based.

The *information technology stage* is aimed at solving the following tasks: students' awareness of the value and significance of mastering the skills of working with cloud services, the importance and effectiveness of their application for solving various tasks of education, education, and development of students; deepening the set of systematic, informational and technological knowledge, improving the instrumental and technical skills of working with cloud services developed at the previous stage of preparation, etc.

At *the quasi-professional stage*, the formation of a stable desire to organize students' cognitive activities using the capabilities of cloud technologies is expected, an improvement of abilities and skills, thanks to which it is possible to

successfully model complete fragments of educational and educational activities using self-developed didactic materials (schemes, electronic posters, virtual interactive boards, electronic tests, questionnaires, web quests, projects) on cloud services and testing of these models in quasi-professional activities; stimulation for self-improvement in this area of the pedagogical activity, etc.

In our pedagogical system, the tactical goal is transformed into *an operative* (procedural and practical) goal, achieved during the study of individual educational disciplines that make up the content of HT training and the methods of their application in the educational process.

It is formulated as generalized knowledge and methods of activity that are formed in students and should be aimed at ensuring that the student can implement the formed knowledge, develop abilities and skills to perform various tasks of professional activity using cloud technologies, can connect the acquired knowledge and develop skills in classes with future professional activities; realize the role of modern information technologies, including cloud ones, in education; understand the technological and didactic potential of cloud technologies for comprehensive development of the personality; was interested in introducing cloud technologies in teaching his subject.

The target component defines the tasks for achieving the set goal, considers the needs, purpose, and motives of future teachers' professional training, and demands future teachers' professional readiness to use cloud technologies in the educational process. The tasks are solved considering the above principles. They aim to achieve the result – increasing the professional readiness of future teachers for using cloud technologies in the educational process.

Revising and constructing the appropriate educational content is necessary to achieve the set goal. Therefore, the next component of the pedagogical system to be characterized is *content.*

It reflects the range of training future teachers in the possibilities of using cloud technologies in the educational process, that is, a set of knowledge, abilities, skills, values, and attitudes in the context of competencies that must be mastered is

assumed.

Within the scope of our research, the content of preparing future teachers for the use of cloud technologies in the educational process will be understood as general and professional competencies, logically organized and fixed in standards, curricula, and work programs, which a student must master to form their professional readiness in this direction of professional activity.

Filling the content of the appropriate training of future teachers was based on contextual, competence-oriented, personally oriented, activity-oriented, and integrative scientific approaches.

The formation of the content of future teachers' training on a contextual basis involves such knowledge, abilities, and skills, the acquisition of which leads to the transition of the informational content of the content to the cognitive one and brings it closer to the conditions of future professional teaching activity [20].

According to A. Kharkivska «the main key competences for lifelong learning are the European Parliament and the Council of the European Union: literacy; language competence; mathematical competence and science competence, technology and engineering; personal, social and educational competence; civic competence; entrepreneurial competence; competence of cultural awareness and selfexpression, as well as digital competence. Forming key competencies occurs by acquiring a set of competences during training, which are a combination of characteristics (related to knowledge and their application, skills, abilities, values and personal qualities) and allow to ensure that professional responsibilities are carried out at a high level» [5, p. 31].

In the context of the competency-based approach, the development of the ability to update one's knowledge throughout life is assumed thanks to a complex of knowledge, skills, and capabilities focused on a specific result, on their assimilation and adaptation to one's own experience.

From the standpoint of the personal-activity approach, the main thing in the content of education is students' personal needs and opportunities in forming professional competencies in educational, cognitive, and communicative activities.

Considering this approach, it is necessary to create conditions to develop future teachers' abilities for self-education, self-improvement, and self-realization regarding the mastery of cloud technologies and the methods of their application in the educational process of a general secondary education institution.

In the context of an integrative approach, the formation of educational content is aimed at a holistic system of professional training of future teachers for using cloud technologies in the educational process.

Within such an approach, interdisciplinary integration is the process and result of the formation of students' knowledge, methods, and activities. We will consider it the structural and logical connections of individual disciplines, which can be characterized by different forms and generate new content integrity.

When constructing the content of the training of future teachers for the use of cloud technologies in the educational process as a whole and the content of a separate academic subject, it is essential to adhere to several principles defined defined in the literature of pedagogical theory and practice (L. Hryzun, V. Zahviazynskyi, V. Kraievskyi, etc.), namely: scientific, systematicity, consistency and continuity, accessibility, the connection between theory and practice, professional and creative orientation, orientation to self-education, interdisciplinary integration.

Taking into account that the content of the training of the future teacher for the use of cloud technologies in the educational process is a component of a complex system of professional education, therefore, it should be provided with the study of disciplines that reveal the relevant context, provided for in the training curriculum and additional optional fields, thanks to the study of which students' knowledge will be deepened, and developed skills will improve.

Considering the above, the professional training of future teachers for using cloud technologies in the educational process has five components: *social-humanitarian, psychological-pedagogical, information-technological, systematic, and practical*. Let us describe them in more detail.

*The social and humanitarian component* («Legal foundations of the modern

state», «Foreign language», «Ukrainian language for professional direction» and «Life safety») is aimed, firstly, at forming the legal basis for using information resources in the field of education; secondly, on the formation of written and oral communication skills in national and foreign languages, as well as the ability to understand the content of information technology and educational texts; thirdly, aimed at forming an understanding of health hazards that may be in the information environment and ways to avoid them.

The following essential component is the *psychological-pedagogical* one («Introduction to the specialty», «Pedagogy» and «Psychology»), it is aimed at acquiring psychological-pedagogical knowledge, developing abilities and skills of organizing the educational process using the capabilities of cloud technologies.

*The information technology component* («Informatics and computer technology», «New information technologies and TZN» («Modern information technologies and TZN») and a specially developed discipline, «Cloud technologies in the educational process») is aimed at forming knowledge, skills of students as ICT-competencies of using cloud technologies in the educational process.

Let's emphasize the importance of the *methodological component* («Methodology of teaching an educational discipline according to the training profile»), aimed at students mastering the methods and technologies of teaching school subjects while studying particular methodological disciplines.

*The practical* component of forming the professional readiness of future teachers to use cloud technologies in the educational process, which is implemented during pedagogical practice, is essential. Its purpose is the formation of the competencies of the future teacher, who can solve various professional problems in practical activities, relying on the acquired knowledge and developed skills, education of the need for systematic professional self-improvement.

So, for example, the educational and pedagogical practice of «Extracurricular educational work» creates the basis for students to gain practical experience in implementing the possibilities of cloud technologies during extracurricular educational activities in various types of secondary education

institutions. To solve this task, students of higher education had to:

1) familiarize themselves with cloud services and technologies to use them in educational work;

2) compile lists of cloud services that can be used to create electronic didactic materials for educational purposes (documents, interactive exercises, online blanks, etc.);

3) develop appropriate electronic didactic materials and work with them, conducting educational activities, etc.

Educational and pedagogical practice «Trial lessons» and pre-diploma (production) practice aim to improve students' professional competencies in implementing cloud technologies for the comprehensive development of students of public secondary education institutions in the educational process. The main tasks for achieving the goal are developing their didactic materials and their use to increase the student's learning process efficiency.

Of course, «a separate issue in the trend of digitalization of the educational process is the implementation of distance learning with new opportunities provided by digital technologies» [4, p. 325].

As mentioned above, especially important in shaping the professional readiness of future teachers for the use of cloud technologies in the educational process are the requirements of interdisciplinary integration of the learning content in the direction of expanding of educational space, in which the student, implementing knowledge from various disciplines of the curriculum, improves the ability to solve professional tasks. So, for example, the ability to create didactic learning tools using cloud services, and personal learning environments, formed in the process of studying the disciplines «New information technologies and technical knowledge» («Modern information technologies and technical knowledge»), «Cloud technologies in the educational process» will become helpful to students during the study of the discipline «Methodology of teaching the academic discipline (by the training profile)».

With the correct definition of the content of the training of future teachers,

it is possible to organize the educational process and implement the acquired knowledge. Therefore, students' attention is focused on developing new knowledge and revitalizing cognitive activity on the formation of students' holistic understanding of the specifics of cloud technologies and methods of their implementation in the educational process, on the construction of professional readiness to organize the educational process using these technologies.

The *technological component* of the pedagogical system of forming future teachers' professional readiness for using cloud technologies in the educational process is provided by systematic tools (forms, methods, means, and pedagogical learning technologies).

The design of the technological component of the pedagogical system takes place in accordance with the purpose of education; for this it is necessary to adhere to specific principles of education. According to the logic of our research, we followed such as:

– *visualization* (the demonstration of cloud service websites, their interface, examples of educational materials developed using cloud technologies, and educational and informational environments are provided);

– *the principle of support* (the student realizes the place of the studied phenomenon in the general system of knowledge, and he develops a holistic picture of the possibilities of implementing cloud technologies in future professional activities);

– *the principle of practical* (professional) orientation (implemented by students in the process of learning a complex of professionally oriented tasks with the use of cloud services);

– *the unity of the individual and group approach* (implemented by the organization of students' educational activities during the implementation of various projects, both individual and group);

– *consciousness and activity in education* (learning to use the possibilities of cloud technologies in the educational process with the introduction of active learning methods).

To organize the learning process aimed at forming future teachers' professional readiness for using cloud technologies in the educational process, it is essential to introduce contextual, interactive, and blended learning elements.

The importance of introducing contextual learning lies in such an organization of the student's learning process when their activities are aimed at revitalizing cognitive activity and developing self-learning skills, as well as forming their ability to use cloud services in the educational process when solving specific professional tasks.

The effectiveness of training future teachers depends on interactive interaction, which can be realized by introducing interactive methods – methods by which participants in the educational process interact. They are based on the principles of interaction, student activity, reliance on group experience, and mandatory feedback. In particular, during various educational tasks, students' motivation increases; the ability to think out of the ordinary and justify one's position is formed, and cooperation skills are improved.

Blended learning involves organizing interaction when the advantages of face-to-face teaching and e-learning are combined. With this form of education, the study of new material is transferred to the educational and informational environment and the organization of interactive interaction of the participants of the educational process in real-time. Recognizing that mixed learning is characterized by interactivity, information availability, a variety of presentation of educational materials, and ensuring network interaction of all participants in the educational process, we believe that its introduction can increase the amount of material to be learned and create an individual learning trajectory for each student, which will contribute to the development of their critical thinking and ability to work independently.

Taking into account the purpose of our research, by mixed learning, we will understand such an organization of knowledge, in which it is possible to combine different forms of education and self-education with the introduction of cloud technologies to activate the cognitive activity of students while mastering

the principles of working with cloud services.

Among all the variety of teaching methods, we selected those, the use of which would contribute to the formation of students' interest and motivation in the introduction of cloud technologies in the educational process, conscious development of information technology skills and abilities, as well as mastery of joint interaction when working with cloud services; striving for self-improvement in the direction of their active application in future professional activities. We consider the most effective:

– stimulation of the motivation of educational activities («Press method», «Brain attack» method, «Circle of ideas», cooperative learning);

– problem presentation (problem-based learning, project method; web quest);

– monitoring and analysis of students' educational achievements (portfolio, reflection). It should be noted that in the training process, we introduce other methods, in particular the following: story, conversation, explanation, instruction, and practical exercises.

When implementing the methods mentioned above, students have the opportunity not only to learn to analyse the assigned task, and proposed proposals, formulate their own opinion, reach conclusions, and condition them with arguments but also to familiarize themselves with the methodology of using various cloud services. Their interest in mastering the educational material increases, and there is an opportunity to organize individual work and communication in small groups.

It is essential to emphasize the organization of students' reflective activities in forming their professional readiness for the introduction of cloud technologies in the educational process.

We suggest that it be organized in such a way that, during training, encourage students to self-assess in determining the level of mastery of these technologies, introspection of pedagogical activities regarding the planning and use of cloud services in the educational process, self-control, and self-regulation, determination of ways to improve pedagogical training using cloud

services.

Modern «the educational and administrative activities use o finnovative technologies (cloudyoriented) in institutions of higher education takes on a global scale, so for example Google is actively working on the improvement of existing and the development and release of new cloud technologies(applications and services)» [17, p. 99].

Among the forms of organization of the learning process, we will consider classical forms to be leading in our research (lectures: introductory, mini-lecture, lecture-visualization, lecture-dispute and brainstorming lecture «brain attack», practical, laboratory, seminar classes, consultations, and independent work), as well as innovative (webinars, courses with analysis of specific situations, video lectures, educational training, and master class).

Web 2.0 is relevant today. According to the scientists, this «is a social service platform that allows any user, in our case, a master, a teacher, a manager, to get, create or be a co-author of information, perform synchronous and asynchronous network communication» [9, p. 242].

We note that «Web 2.0 technology is based on social networking services that support the involuntary development of communities consisting of people interested in sharing information, developing specific problems, and communicating» [9, p. 242].

A. Prokopenko came to the conclusion that «in the cloud model, the primary functions are performed by centralized data centers that collectdata from the far nodes of the network and find them a further application. Clouds containing millions of terabytes of information, all have IT giants: Apple, Google, Intel and others. In the cloud modela lot of things depends on the bandwidth of the channels through which information is exchanged between the cloud and theperiphery. According to the authorsof the idea of fog computing, the transfer of a significant part of this work «in place» will increase the speed of decision-making. Centralized «cloud» and decentralized «fog» do not exclude each other but rather complement» [17, p. 99].

Improving the effectiveness of the pedagogical system depends on the choice of means of forming future teachers' professional readiness for using cloud technologies in the educational process. In this context, it is essential to use cloud-based learning tools, by which we understand cloud services that are used in various types of academic and educational activities to solve specific educational tasks. Among their variety, following the pedagogical possibilities that they implement in the educational process, we suggest using the following groups of cloud services: services for data storage and publication of didactic materials; information visualization services; services for creating interactive game exercises; services for the organization and management of education. Continuing, we will characterize the next component of the pedagogical system.

The *subject-object component* reflects the requirements for a teacher of institution of higher education (the subject of the pedagogical system) and reveals the professional characteristics of the student (the future teacher – the object of the pedagogical system), which ensure the acquisition of knowledge, practical skills, methods of action in the context of the methodology of using cloud technologies in the educational process. In the learning process, the interaction and relations between the teacher and the student are subject-subject.

We will reveal the essence of the subject of the pedagogical system. Based on the views of scientists (O. Briukhovetska, V. Hladush, V. Zakharova, Ya. Kulbashna, V. Oluiko, K. Polupan, M. Suprun, E. Tkachuk, etc.), who make demands on modern teachers of institution of higher education, we note that the professionalism of a higher schoolteacher consists in the effective implementation of the system of professional knowledge and skills: *special, psychological and pedagogical, methodical, organizational* [6, p. 87-88].

Among the professionally important positive qualities of a teacher at a higher education institution, thanks to which it is possible to successfully form the professional readiness of future teachers to use cloud technologies in the educational process, we singled out the following: organization, speed of decision-making, responsibility, independence, the ability to conduct dialogue,

creative activity, attentiveness, strategic and analytical thinking, a developed intuition, psychological stability, ability to empathize, sense of tact, restraint, perseverance, hard work.

A modern teacher must possess thorough professional knowledge, be able to develop systematic innovations, form an individual trajectory and organize anticipatory training, achieve a high level of formation of communication skills, possess project management technology, implement modern learning technologies, create conditions for complete self-knowledge and self-realization of students. Working with students, he needs to improve constantly. The teacher must quickly sense certain situations that may arise in the learning process; to solve them, he must implement a creative approach and get out of them without violating the principles of tact and mortality [8, p. 142].

A modern teachers must be not just a lecturer, speaker, or translator of knowledge but also a motivator, an innovator of the educational process, a tutor, a mentor, a coach, a facilitator, manager.

They should be aware of the urgency of the problem of introducing cloud technologies into education and the prospects of their application in the educational process, and, accordingly, the need to form the professional readiness of future teachers in this direction. Such teachers are pedagogical strategists and authors who design new approaches and models for using cloud technologies in the professional training of future teachers.

Once again, we emphasize that to perform this task teachers must have a thorough knowledge of the pedagogical capabilities of these technologies, the classification and purpose of cloud services, methodological and technological requirements for organizing work with them, possible options for their application in the educational process, and the legal basis for using them.

It is essential that teachers of institutions of higher education must confidently possess the skills of network communication, new forms, and methods of learning, first of all, the technique of conducting video conferences, webinars, web quests, online discussions, projects, quizzes, contests, etc. Teachers must

competently and clearly express their opinion in writing, add elements of emotionality in written expression, and effectively vary them in virtual interaction, organize group (cooperative) and collective activities using cloud technologies during student education.

By involving students of education in such cooperation, their ability to organize various models of mutual interaction in the educational process will be formed. They will also overcome communication and psychological-cognitive barriers in virtual communication.

In addition to the above, it is significant for the teacher to be aware of the need to create such conditions under which the interest and creative activity of students would be stimulated to gain experience in creating professional scenarios for the use of cloud technologies in the educational process. It is expedient to organize such an active cognitive activity, which expands the creative potential of the students of education, improves the ability to find ways to combine various, at first glance unrelated, cloud services, solve numerous tasks of the educational process, establish the primary connection between the known and new information with reference to previously acquired experience; students' reflective skills are improved, self-control and self-assessment skills are formed and developed.

We are convinced that while forming the professional readiness of future teachers for the use of cloud technologies in the educational process, teachers must expand interdisciplinary connections; create academic tasks and situations, thanks to which students will gain experience in future professional activities; continuously implement cloud technologies at all stages of their training in the institution of higher education; to involve students in independent project-research activities on the development and application of scenarios for the introduction of cloud technologies in the educational process.

We have reason to focus on the characteristics of the student (future teacher) in the context of his professional readiness to use cloud technologies in the educational process – as an object of the pedagogical system being formed.

In this system, the student, as an object of the pedagogical process, acquires

experience and knowledge, develops skills, and improves skills.

He is an individual who creates and improves by the pedagogical goal. As a subject of the pedagogical process, a learner is a person with his views, strong and weak traits, endowed with natural needs and aptitudes, who strives for creative self-expression, the satisfaction of his own needs, can choose the trajectory of development [10, p. 18; 12, p. 57; 13, p. 77].

According to A. Kharkivska, the competence approach «involves the ability to create and make changes to the teacher's own professional activities, taking into account the needs and demands that will put before education the future society. competency-based approach – a new way to determine the results, the initial parameters of educational activities» [5, p. 33].

Characterizing his *personal* component, we note that among the most important personal and professional qualities of future teachers, which influence the success of their work, are deep professional knowledge, general erudition, the logic of thinking, a critical approach to solving problems, own point of view, organizational skills, principled ness, communication skills and abilities, independence, initiative, benevolence, understanding of the student's mental state, empathy, self-organization, the ability to foresee and forecast, etc.

The active implementation of cloud technologies in the educational process determines the *professional characteristics* of the future teacher, thanks to which he will work successfully for the student's comprehensive development. Important such characteristics are:

– understanding the didactic potential of cloud technologies in the student's progress, his individual and creative abilities;

– responsibility for the results of the student's learning process taking into account health-saving technologies;

– the teacher's awareness of the importance of anticipatory development of students under the conditions of informatization of education;

– awareness of the creative direction of his work, thanks to which the teacher achieves qualitatively new educational results. Pedagogical creativity should

be reflected in the use of electronic didactic materials created by the teacher using cloud services; in the development and implementation of various network activities for students, for example, web quests, online quizzes, contests, etc.; in the active implementation of the hybrid technology of teaching students and the «inverted classroom» technology to ensure the productive educational and cognitive activity of students during the lesson and outside of the study. The teacher must constantly enrich students with the experience of creative activity, revealing their creative potential, forming a mechanism for the self-realization of each student's personality;

– the ability to build partnership relationships between subjects of the educational process. The teacher needs to solve various pedagogical tasks in dialogue, demonstrate examples of dialogical knowledge, and help the student cooperate and co-create during academic studies; to create situations of psychological comfort with a respectful and interested attitude of interaction participants to someone else's position, to strive for a collective search for a solution, to refuse authoritarianism in the discussion;

– the teacher's awareness of the role of the organizer of educational activities when implementing cloud technologies in the educational process. He must correctly plan and control the scholarly activities of students. The teacher has to develop the ability to distribute work among pupils correctly;

– the transition of the teacher to the facilitation position. He should pay more attention to the emotional state of students and create an atmosphere of mutual understanding and trust. His efforts should be directed to the organization of interactive communication to develop the student's personality using cloud technologies comprehensively.

In addition, a student needs to have a set of necessary knowledge (general theoretical, psychological-pedagogical, methodical, information-technological), abilities, and skills (organizational, projective, methodical, creative, communicative, instrumental-technological, reflective), which characterize cognitive-activity and reflective components of the personality of the future

teacher in the context of his organization of the educational process with the use of cloud technologies.

The next component of the pedagogical system, namely the environmental, it acquires particular importance. It is provided by a specially created cloud-oriented educational and informational environment for training future teachers to use cloud technologies. The functioning of such an environment in the educational process changes the communication style of its subjects; the education students will quickly learn the methods of independent knowledge, search, experiment, and improve cooperation and teamwork skills.

We will present it as a relationship of four components: program-methodical, communication-control, result-corrective, and technological.

The software-methodical component provides informational-methodical support of the educational process (implemented through placing and storing educational-methodical materials in the cloud and setting up permanent access to them).

Communication and control ensure the organization and implementation of various types of online and offline communication interaction and cooperation of subjects of the educational process (teacher – students, teacher-student, student-student, student – students) during various tasks.

The communication unit provides the ability to identify students and differentiation their right to access educational resources; determination of the degree of involvement of students in certain types of work *(self-evaluation, peer reviews, the joint resolution of evaluation criteria, etc.)*, communication with the participants of the educational process *(organization of contact with students online and offline, simultaneously and in a convenient mode without time limits)*, informing about changes in the course, in the particular posting of notices about the webinar, educational and methodological materials, assignments, evaluation criteria, notifications about deadlines for completing and sending jobs.

The *Monitoring and Evaluation block* provides an opportunity to implement a quality assessment check of the knowledge acquired by students, developed

abilities, and skills provided by the work programs. It contains means, evaluation, and control criteria (test tasks, a list of questions for assessment, and information about evaluation criteria).

The *Reflection block* aims to organize reflective activities of students in the process of mastering the possibilities of using cloud technologies in the educational process and to form reflective skills in future teachers to be aware of their ways of acting when performing the proposed tasks.

*The result-corrective component* ensures obtaining the result and correcting the educational activity of students throughout the entire period of study, designed in the form of a web portfolio.

We agree with A. Prokopenko that «the use of foggy technology will improve the management of higher education institutions, improving of educational process of training future specialists and specialties for which training is call, and advanced raining for scientific-pedagogical and pedagogical workers of the educational institution. Prospects of further scientific search is seen in the introductionto the work of higher education institutions educational-scientific laboratory of innovative technologies to test the effectiveness of the misty technologies» [17, p. 101].

The *technological component* is implemented through specific cloud resources of various functional purposes, which provide support for the educational process (that is, resource and instrumental support for academic and cognitive activities of higher education students is created). This block makes it possible to provide conditions for the organization of the educational process using cloud technologies in professional training., conditions are made for the organization of the educational process with the use of cloud technologies in professional training.

Note that in this environment, the content of the teacher's activity changes. He must be able to form content in it, know the functionality and possess the toolkit of cloud technologies for organizing productive interaction of students, and be able to develop electronic didactic materials under such a learning model; to

create conditions for the more effective independent educational and cognitive activity of students, in the process of which they, relying on the content, discover new knowledge. The teacher can control each student's learning process, correct their work in time, effectively manage the learning process, and organize students' work according to individual learning trajectories. During training using such an environment, students are convinced by their own experience of the importance of gaining practical experience to organize this kind of activity in the future.

**Conclusions.** Summing up, the pedagogical system developed by us for the formation of professional readiness of future teachers for the use of cloud technologies in the educational process is supplemented with an environmental component, and each proposed part is filled with its content.

Such a model of future teacher training is proposed, which has been improved following the requirements of the information society and the needs of general secondary education institutions in highly qualified teachers with a formed readiness to use modern ICT in the educational process, in particular cloud-based, in compliance with state requirements.

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