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Development of research competence in university students through cloud-oriented technologies: a pedagogical experiment

Розвиток дослідницької компетентності студентів університету за допомогою хмарно-орієнтованих технологій: педагогічний експеримент

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Abstract

This article explores the content and main directions of scientific and research activities in higher education. It highlights the key types of research work and conceptual tasks undertaken in these institutions. The study clarifies the interconnected elements, components, principles, and priority areas for organizing, developing, and enhancing the effectiveness of students' research activities. It emphasizes the need to integrate creative methods and cloud-oriented technologies into higher education to foster the creative abilities of future professionals. To assess the effectiveness of these approaches, a pedagogical experiment was conducted. The hypothesis posited that a well-organized research process in higher education institutions leads to a high level of research competence in senior undergraduate and graduate

Анотація

У статті розкрито зміст та основні напрями науково-дослідницької діяльності. Виокремлено основні напрями, види науково-дослідницької роботи та концептуальні завдання наукової діяльності в закладах вищої освіти. З'ясовано взаємопов'язані елементи, компоненти, принципи, пріоритетні напрями організації розвитку та підвищення результативності науково-дослідницької діяльності студентів. Наголошено на необхідності упровадження в освітній процес вищої школи креативних методів та хмаро орієнтованих технологій, які спрямовані на підвищення творчих здібностей майбутніх фахівців. З метою перевірки ефективності організації експериментальної роботи студентів був проведений педагогічний експеримент. Гіпотеза заключалась у твердженні, що результатом якісної організації освітнього

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students. During the experiment, cloud-based technologies and innovative research methods and forms were implemented in university education.

Keywords: research activities, cloud-oriented technologies, quality of education, higher education institutions, research competence.

процесу в закладах вищої освіти науково-дослідної роботи є високий рівень сформованості дослідницької компетентності в студентів старших курсів бакалаврського та магістерського рівнів. Під час екстериментального дослідження здійснено впровадження у практику університетської освіти хмаро орієнтовані технології та розроблені нами методи і форми науково-дослідної роботи студентів.

Ключові слова: науково-дослідницька діяльність, хмаро орієнтовані технології, якісна організація освітнього процесу, заклади вищої освіти, дослідницька компетентність.

Introduction

For a modern graduate of a higher education institution, the formation of readiness for scientific and research activity is relevant today (Varava, 2021).

In order to solve the task of training a competitive specialist in modern conditions, higher education institutions need to pay attention to the development of research skills and creative initiative in students, since scientific and research activities form in competitive specialists the ability to analyze, the need for continuous education, the ability to make decisions, educate independence, cognitive activity , flexibility of thinking, that is, it forms the research competence of students by means of cloud-oriented technologies, which is current today because the labor market requires the formation of only specialists with a high level of professional competence, competitive and ready for self-improvement, capable of generating new ideas, analyzing, researching, adequately responding to changes in the social and professional sphere, to act independently and creatively, to think, to grow professionally, Therefore, the introduction of new educational technologies is now necessary to form the research competence of students, in particular, cloud-oriented technologies that are current today and are aimed at increasing the creative abilities of future specialists (Povidaichyk et al., 2020).

Taking into account the development of society, there is a growing need for specialists ready to analyze, search, and systematize information; in specialists with innovative, non-standard thinking. The formation of students' research competence, which is current today, reflects the trends of modern education and is aimed at increasing the creative abilities of future specialists, and contributes to the individualization of the educational process and the development of student's creative abilities (Khromchenko, 2021).

The analysis of available cloud-oriented multimedia educational resources demonstrated the overwhelming lack of quality control of these resources and the unsystematic nature of their introduction into the educational process. Determining the quality of cloud-based educational resources and developing methodological recommendations for their use for teaching students' research competence is an urgent task.

The analysis of the theory and practice of the researched problem revealed the following contradictions between:

- The global digital transformation of education and the unpreparedness of higher education institutions of Ukraine for the full implementation of digital technologies in the educational process;
- The change of classical means of education in accordance with the needs of students and the insufficient level of preparation of scientific and pedagogical workers for the design and implementation of cloud-oriented educational resources in the educational process;
- Updated requirements for teachers' competencies and graduates' unpreparedness for these changes;
- The availability of freely distributed multimedia educational resources and the lack of a well-founded methodology for their use during student education.

The application of such a cloud-oriented environment in the educational process is currently a topical issue of the theory and methodology of using ICT in education. Based on this, we considered the following questions in the article:

1. Content and main directions of scientific research activity.
2. Main directions, types of research work, and conceptual tasks of scientific activity in institutions of higher education.
3. Interrelated elements, components, principles, priority areas of organization, development, and improvement of the effectiveness of scientific research activities of students.
4. Creative methods and cloud-oriented technologies aimed at increasing the creative abilities of future specialists.
5. Experimentally tested the development of research competence of university students with the help of cloud-oriented technologies.

Literature Review

In modern conditions, there is a need to train a competitive specialist. In this regard, attention is currently being paid to the scientific and research activities of students in the process of professional training.

In the context of scientific-subject foreign language training, R. Pavliuk (2016) theorizes the approaches and views of modern scientists to the design of the system of scientific and research activities of students, offers actual ideas of scientists regarding the development of pedagogical conditions for the organization of scientific and research activities and substantiates modern approaches to scientific and research activities of students, suggests the implementation of the developed pedagogical conditions for the organization of students' research activities, determines the advantages and identifies the shortcomings in general approaches to the organization of students' research activities.

On the principles of academic integrity, I. Varava (2021) shows the peculiarities of the implementation of pedagogical support for the formation of the readiness of future specialists for scientific and research activities. The scientist draws attention to the importance for the student of the formation of readiness for scientific and research activity and singles out the most important condition of scientific and research activity – compliance with the principles of academic integrity.

O. Doronina (2017), engaged in the training of a specialist in the field of economics and management, determines the directions of development and substantiates the role of the student's scientific activity in the formation of professional competencies in modern education, and defines the priority competencies for employees in the field of economics and management for the near future, defines the forms of scientific activity of students, which contribute structured by types of relevant skills and the formation and development of professional skills. The principles and principles of the development of students' scientific activity are revealed and priority directions for its improvement in higher education institutions are proposed, which will contribute to the strengthening of intellectual potential and the activation of the labor market.

O. Bulvinska, N. Divinska, N. Diachenko, O. Zhabenko, I. Lyniova, Yu. Skyba, H. Chornoivan, & O. Yaroshenko (2016) substantiated the methodological approaches and conceptual foundations (based on the historical discourse of foreign experience) for the implementation of scientific research activities of subjects of the educational process of universities; revealed the stages of formation and the essence of the educational environment of universities, singled out approaches to research training in foreign countries, the main components of the development of research competence, the methodology of teaching based on research, showed the main mechanisms of the development of a researcher's career in the higher education system, proved the effectiveness of forms of approbation of the concept of implementation research activity at the master's level of higher education applicants.

The study of O. Khromchenko (2021), who singled out the main components of the research activity of training competitive specialists, proved that "the scientific and research activity of future specialists is a type of independent creative activity of a search nature, which students perform under the leadership of a teacher of a higher education institution to acquire and generalize knowledge, developing creative abilities and research skills, creating internal motivation for learning, forming independence as character traits, willpower, ensuring the culture of scientific work". O. Povidaichyk, M. Herych, & M. Povidaichyk (2020) pay attention to the development of students' research skills, creative initiative, the need for continuous education, the ability to make and analyze decisions, the education of flexibility of thinking, cognitive activity, independence, that is, the formation of key professional competences through the introduction of scientific research activities into the educational process, involving students from the first years, to expand

the ideas of future professionals about scientific research in the context of the future profession, creating conditions for the development of their scientific research abilities. Scientists have developed conditions for the free self-realization of students, and future specialists, which is optimal in the aspect of scientific research, and communication between junior students and teachers and which is aimed at increasing motivation to solve research tasks chosen by students of higher education.

Scientists I. Maldonado Ramírez et al. (2023) in the article attempt to determine the current state of the applied level of information technologies. The researchers analyzed information and communication and cloud computing and their contribution to quality assurance and management in public universities.

Researchers B. Torres Chumbes, E. Quispe Alcca & B. Hermitaño Atencio (2022) reviewed the use of effective information technology teaching methods in student learning. Their study was developed within the framework of a quantitative approach with a pre-experimental design and proposes to determine the elationship that exists between cloud services and attitudes towards information technology among students.

Despite the significant interest of scientists in the researched problem, insufficient attention is paid to the organizational and substantive aspects of the research activity of junior higher education students in the process of their professional training, as well as to the formation of research competence of students through the use of cloud-oriented technologies that are available today, which aimed at improving the creative abilities of future specialists.

Purpose of the research: for qualitative organization of research work in institutions of higher education, to show the ways of formation of research competence in students of bachelor's and master's levels.

Methodology

To achieve the goal, research methods were applied at the research stages: theoretical – abstraction, analysis of the subject of study; definitive analysis of the thesaurus of the pedagogical problem; empirical – organizations observing the object of research to ensure the profiling of the educational process; comparative studies; pedagogical experiment; statistical – processing of research results.

To check the effectiveness of the organization of students' experimental work, we conducted a pedagogical experiment that lasted during the initial year of 2022-2023 in stages: ascertainment and formative.

The purpose of the confirmatory experiment was to confirm the expediency and relevance of research on the chosen topic.

The formative experiment consisted of two stages: initial and summary-analytical.

202 students of higher education were involved in the experiment, they were senior year students of bachelor's and master's levels.

Participants of the experimental group (EG) (100 people) were involved in scientific research and active work, they actively participated in scientific competition events: presentations of scientific projects, round tables, seminars, conferences, exhibitions, lectures, debates, intellectual games, Olympiads, meetings with famous scientists, competitions, as well as in other events aimed at stimulating scientific research.

Participants of the control group (CG) (102 people) studied according to the program of the unchanged curriculum. Their scientific and research work was mainly carried out in the process of approbation of research results in scientific publications and during scientific and pedagogical practice.

Our hypothesis consisted of the statement that the result of a high-quality organization of scientific research work in higher education institutions is a high level of research competence development in students of senior years at the bachelor's and master's levels.

To diagnose the level of development of students' research competence, we selected point indicators: During the study, we used our own observations of students' preparation for future professional activities,

the method of independent characteristics of teachers, conversations, surveys, analysis of practice, introspection, observation of students' actions during round tables, training, conferences, resolution of discussions and resolution of pedagogical situations.

To determine the reliability of the distribution of students into experimental and control groups, according to the results of the experiment, the λ-criterion of Kolmogorov-Smirnov was used, which made it possible to find the point at which there is the largest sum of accumulated differences between the two distributions. The value of the criterion λ is not significant.

The empirical distribution of the levels of formation of research competence in the control and experimental groups practically does not differ. This allowed us to conclude the correctness of the division of groups into control and experimental groups.

According to the results of the initial stage of the experiment, it was proved that the majority of respondents are not motivated for scientific work, are not sufficiently convinced of the need to develop research competence, do not consider it to be the most important component of the future profession, and not everyone gets satisfaction from scientific research work.

It is shown that specially organized, purposeful work on the formation of research competence using cloud-oriented technologies, which is current today, is necessary.

At the final and analytical stage of the formative experiment, cloud-oriented technologies and the methods and forms of students' research work developed by us were implemented into the practice of university education; control sections were conducted to identify the level of formation of students' research competence using cloud-oriented technologies. The same methods were used at the initial stage of the experiment. Indicators of the levels of students' research competence in the initial and final analytical stages of the experiment have changed. The results of the research in the experimental group prove that the experimental work contributed to the formation of students' research competence using cloud-oriented technologies that are current today. Indicators did not significantly increase in the control group.

After conducting the formative experiment, the obtained results are statistically significant.

Research relies heavily on the accuracy and reliability of the data. In the framework of research work, the quality of data collection and analysis not only adds weight to the research, but also contributes to the formation of sound conclusions, which is the key to academic success.

The following digital data collection tools were useful in the study:

- Google Forms - a simple tool for creating surveys that allows you to collect data from respondents, create different types of questions and collect answers in spreadsheets.
- SurveyMonkey - a modern survey tool that offers a wide range of customization options and analytical tools for analyzing the collected data.
- JSTOR, Google Scholar, and other academic search engines to provide access to scholarly articles, books, and other academic resources that may be useful for literature review and theoretical data collection.
- Zotero or Mendeley - bibliography management programs that help organize research materials, store references, and format bibliographies and citations according to different citation styles.
- Microsoft Excel or Google Sheets - spreadsheets are useful for organizing and analyzing collected data when working with quantitative data.
- SPSS, R or Python for more advanced data analysis, for statistical analysis and processing of volumes of data.

Results and Discussion

1. Content and main directions of scientific research activity.

We present scientific and research activity as the practice of knowledge obtained through scientifically based, new components aimed at systematically changing social reality, which is implemented through the

application of appropriate methods and forms of scientific knowledge in a logical sequence (Povidaichyk et al., 2020).

The readiness of bachelor's and master's students for research work covers the following areas:

- Research traits of students (observation, sense of the new, inquisitiveness, initiative, willingness to take risks, objectivity, attentiveness, activity, cognitive independence, systematicity, consistency, purposefulness, research tact);
- An active positive attitude towards the research work of undergraduate and master's students (level of development of motivation, inclination to scientific research, understanding of the need for research work, creative and searching position, value orientations, highly developed abilities, and cognitive interests, research style of thinking);
- Knowledge system (knowledge of the subject, knowledge of pedagogical technologies, mastery of ideas, scientific concepts, mastery of methods, logic, theoretical and practical apparatus of scientific and pedagogical research);
- System of skills (intellectual, research, constructive, organizational, educational-intellectual, projective, analytical, cognitive, communicative, general education skills);
- Moral and volitional personality traits (interest in business, attentiveness, purposefulness, humanity, decisiveness, organization, responsibility, sociability, reliability, ambition, benevolence, persistence in achieving a goal, independence);
- Intellectual development of the student (formation of ideas, views, beliefs, scientific outlook, general erudition, development of abilities, skills, abilities, abstract-logical memory, creative imagination);
- Professional traits of a student of higher education (pedagogical tact, professional psychological position, creative pedagogical thinking, the ability for self-improvement, professional interest, reflection, interest in business, punctuality, thoroughness, high level of methodological, pedagogical, and general culture) (Bilostotska, 2009).

In the process of scientific and research activities of higher education students, pedagogical assistance includes:

- Encouraging students to engage in research activities;
- Permanent stimulation of students to research activities, aimed at the constant growth of motivation to solve selected research tasks by students of higher education. A prerequisite for the process of scientific research activity of students is the establishment of positive relations between the student himself, the group of students, and the teacher. It is necessary during scientific research activities to ensure the freedom of choice of the types of activities offered to the student;
- Assistance to students of higher education in choosing, setting, and solving research tasks adapted to the profession, which is implemented through providing conditions for free self-realization, providing the opportunity for self-determination, optimal communication in the aspect of scientific research between teachers and students;
- The inclusion of the theory of scientific research and the basics of methodology in the content of teaching general disciplines and the inclusion in the educational process of information about current scientific problems in the future profession (Puhach et al., 2021).

In the process of scientific research work, an important aspect for students, as full-fledged subjects of scientific research activity, is parity in the "teacher-student" relationship, which is realized through the involvement of future specialists in scientific research. Educational influence gains the greatest strength during a demanding and careful attitude to the results of students' work. In the process of implementing the studied pedagogical conditions, the most appropriate is – a democratic style, which allows the student to consider himself as an equal partner in a joint search and communication.

Starting from the first year of study, the scientific and research activity of students involves – ensuring their free self-realization (Rojas Bahamón et al., 2019).

When realizing oneself by one's capabilities, as students are ready for scientific research activity in solving a research task: a need may arise, a desire to do things in one's own way may arise, dissatisfaction with the function of the executor may arise. Then the teacher should "support the student's desire for "freedom from"

(the situation in which the student is) and "freedom for" (creating favorable conditions for self-realization)" (Povidaichyk et al., 2020).

2. Main directions, types of research work, and conceptual tasks of scientific activity in institutions of higher education.

The scientific and research activity of students at the institution of higher education is carried out in the following main areas:

- Scientific research activity, which is mandatory for all students and is a component of the educational process (preparation for classes, writing essays, preparation and defense of term papers, diploma theses, the performance of tasks commissioned by enterprises during the period of production practice of a research nature, etc.);
- Research activities of higher education graduates outside the educational process, within the creative cooperation of departments – performing scientific works, participating in scientific circles, writing publications, theses of scientific reports, etc.

The teacher forges several tasks during the scientific research activity of students at a higher education institution, namely:

1) Introduces the scientific research methods of the executors of scientific research work, and teaches them to apply them in practice, including innovative methods and cloud-oriented technologies available today, which are aimed at increasing the creative abilities of future specialists;
2) Teaches to identify an actual scientific problem, independently organize and plan scientific research work, determine specific goals, find ways to solve the set goal, apply methods of practical verification, formulate a research hypothesis, conduct experimental research, prepare research results by established requirements, prove for science and practices, the usefulness and correctness of the obtained results, to defend one's point of view in scientific discussions through public defense, participation in seminars, conferences, etc.;
3) Forms the qualities of a professional researcher in students (Kravchenko et al., 2022).

Therefore, the teacher needs not only practical skills and knowledge (based on the results of his own research) on the methodology of conducting scientific research, to organize a high-quality innovative educational process but also the implementation with the involvement of students of the results of research, relevant research skills, a formed readiness to perform scientific research work, skills in the field of using innovative learning technologies, cloud-oriented technologies, which are available today and are aimed at increasing the creative abilities of future specialists, etc. (Bulvinska et al., 2016).

The main types of research work of students in institutions of higher education are:

- Training of highly qualified specialists who possess the necessary practical and in-depth theoretical knowledge;
- Effective use of students' creative potential to solve current problems of technology, science, and technology;
- Development of new methods, technologies, teaching methods, and tools;
- Professional development during life;
- Introduction of new scientific results into the educational process;
- Conducting exploratory research at the expense of grants or the expense of institutions, organizations, and enterprises interested in scientific development;
- Creation of conditions for carrying out scientific work (Kuchai et al., 2017); (Bulvinska et al., 2016).

3. Interrelated elements, components, principles, priority areas of organization, development, and improvement of the effectiveness of scientific research activities of students.

The scientific and research activity of students in a higher educational institution is a creative process that includes interrelated elements (Tsekhmistrova, 2004):

- Teaching students methods and organization of scientific creativity, elements of scientific and research activity;

– Initiative, under the guidance of teachers, scientific research carried out by students.

Scientists have highlighted the components of scientific research activity of students in a higher educational institution:

– *Motivational* – motives, as a reason for choosing the direction of activity; needs as sources of personality activity; aspirations, emotions, instructions, desires, as regulators of activity dynamics;
– *Cognitive* – the availability of theoretical knowledge from professional disciplines, knowledge about the organization of students' research activities, knowledge about the peculiarities of students' research activities (Sultanova, 2018);
– *Value-motivational* – moral-ethical, spiritual, material, cognitive interests and needs; a system of value orientations of a person and a person's beliefs as a guarantee of self-development and own self-realization, regarding the purpose and essence of future professional activity; interest as an important source of professional needs in scientific and research activity and the growth of creative potential, the formation of motives for research activity, the formation of persistent interest in learning the pedagogical process, the desire through scientific and research activity for self-improvement, in the improvement of the pedagogical process, understanding the valuable role of research;
– *Meaningful* – systematic mastering of knowledge on the methodology of scientific and pedagogical research and methodology, identifying the essence of the main contradictions and ways of solving them in modern education; separation and selection for the study of the most effective stages of research, components, types, forms, principles, methods of scientific research; development of innovative technologies, models, and methods of implementation in practice; formulation of conclusions and knowledge of the basics of statistical processing of the obtained results; disclosure of the content of research activities in educational institutions;
– *Operational* – the ability to conduct scientific and pedagogical research, that is, to process and accumulate scientific information, search, critically analyze the real state of the studied phenomenon and analyze scientific literature; to possess the methodological apparatus of research, to forecast the development of the researched problem, to introduce pedagogical research into the work system of educational institutions, to apply the optimal system of methods of research work, to correctly design the results of scientific work; conduct and defend experimental work; objectively determine the effectiveness of the conducted research; the ability to cooperate with a team; apply new effective learning models and technologies; generalize, study, implement innovative pedagogical experience; to organize the work of student scientific groups; plan and conduct seminars, conferences, contests, Olympiads, etc. – mass events;
– *Procedural and operational* – the presence of such characteristics as organization, initiative, self-control, self-discipline, independence, persistence, activity, consistency, objectivity, productivity, creativity, creativity;
– *Reflexive-resultative* – systematic mastery of self-assessment skills, self-observation, self-regulation, self-analysis, self-control, and self-assessment of the results and process of one's own activity (Bilostotska, 2009).
– *Design component* – the ability to determine the object and subject of research, to identify and formulate problems, to define basic concepts, the ability to plan research activities, to formulate the purpose and hypothesis of research;
– *Informational component* – mastery, by the research problem, of methods of data collection, processing of sources of various information;
– *Analytical component* – the choice of special research methods and the use of universal ones, creative abilities, developed logical thinking;
– *Practical component* – presentation, formulation, and implementation of research results into practice (Holovan & Yatsenko, 2012).

The formation of a future specialist's readiness for scientific and research activities is a pedagogically complex process, and it is appropriate in higher educational institutions to observe the principles in the field of pedagogical sciences in the organization of students' scientific and research activities: scientificity; systematicity; individualization; integration of professional training and research process; self-organization; scientific and methodical consulting; monitoring (Budnyk et al., 2022); (Doronina, 2017).

Holistic, comprehensively implemented scientific and research activity of higher education students ensures the solution of the following tasks:

- Formation of the scientific worldview of higher education graduates and mastering of scientific research methods and the methodology of education;
- Development of student's individual abilities and creative thinking in solving practical tasks;
- Assisting those seeking higher education in achieving high professionalism and accelerated mastery of a specialty;
- Development of the ability and initiative to apply theoretical knowledge in practical work, involvement of the most capable students in research;
- Inculcating the skills of independent scientific and research activity by a higher education seeker;
- Development of existing and creation of new creative collectives, scientific schools, training of researchers and scientists in those who acquire higher education;
- Expanding the scientific erudition of the future specialist and the theoretical outlook of the individual;
- The need to improve knowledge and constantly update it (Sheiko & Kushnarenko, 2004).

4. Creative methods and cloud-oriented technologies aimed at increasing the creative abilities of future specialists.

Let's consider creative methods of scientific and research activity, which contribute to the formation of professional creativity, ensuring that students obtain subjectively new knowledge of an educational or scientific nature.

The creative methods we use in our work include the following: "Brainstorming"; figurative picture; agglutination and hyperbolization. Resources that contribute to the implementation of such methods in the educational process, contribute to the practical application of rules and hypotheses, and contribute to the search for ways to solve scientific tasks – are network tools that allow organizing collective work on a scientific project (Correa Cruz et al., 2017).

Such resources include, according to the scientific project, the creation of joint documents in the cloud on Dropbox, Google Drive, Zoho, and OneDrive, generating ways to solve the scientific problem, planning joint work using network resources that contribute to the implementation of tasks in the organization of collective work, project management: RealtimeBoard, Trello, Kanbanchi, PodiO (Knysh et al., 2023).

The introduction of such tools into the research activity of students intensifies the use of creative methods of research activity: "Brainstorming"; figurative pictures; agglutination and hyperbolization. Joint discussion of scientific problems in joint work on projects allows to motivate and involve students in scientific activity.

Blogs and wikis are Web 2.0 applications, and since they are hosted in the cloud, we understand them as cloud-oriented technologies based on the Saas service model (Lytvynova, 2014), which are characterized by the key properties of cloud infrastructure (elasticity, pay-as-you-go, etc.).

It is worth noting that students can independently edit and create content, using wiki resources and blogs, that is, present the results of their scientific work. Students and teachers, that is, network users, can evaluate, analyze, edit, and comment, that is, the very process of forming scientific materials becomes controlled.

Blogs, which we implement in the educational process of higher education for high-quality, innovative professional training of future specialists, perform the following functions: communicative; grouping and maintenance of social ties; self-presentation; self-development or reflection; psychotherapeutic, etc.

We used different types of blogs to organize various forms of research activity:

- The blog of a scientific leader or teacher – to provide coverage of the organizational and operational stages of scientific and research activities;
- Blog of a group of students – for project work, work on one scientific problem;
- Student's blog – to create and support the student's independence, which makes it possible to display the results of his research activities. The introduction of this type of blog into scientific research activity promotes the stimulation of students' involvement in conducting research, conducting research planning, increases the responsibility of each student for the materials posted on the blog, provides the

opportunity for self-organization of each student, reflection and reviews, and participation in various forms of scientific research activity in higher education (Proshkin et al., 2018).

5. Experiment.

To check the effectiveness of the organization of students' experimental work, we conducted a pedagogical experiment that lasted during the initial year of 2022-2023 in stages: ascertainment and formative.

When determining the sample of subjects, the general specificity of the subject of the study was taken into account. The total sample size is 202 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 implementation of the pedagogical experiment was carried out in three stages: preparatory, main and final.

At the preparatory stage, the purpose and tasks of the research were determined, the experimental plan was developed, methods of measurement and processing of results were selected, control and experimental groups were selected, and their homogeneity was checked.

At the main stage, an experiment was conducted.

At the final stage, the results of the experiment were analyzed, their reliability was confirmed, and conclusions were drawn about the pedagogical effect of the experiment.

The reliability and validity of the obtained results, the objectivity of their assessment was 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).

The purpose of the confirmatory experiment was to confirm the expediency and relevance of research on the chosen topic.

The formative experiment consisted of two stages: initial and summary-analytical.

During the ascertainment experiment, educational-methodical, pedagogical, philosophical, psychological, and literature were analyzed and summarized to define basic concepts, clarify the essence of concepts, and theoretical-methodological foundations of research, and identify and classify methods and forms of experimental work.

In the process of the formative experiment, knowledge sections of the questionnaire were made, conversations were held with students and with teachers, and a complex of diagnostic procedures was developed to identify the level of skills, abilities, and knowledge of students on improving the organization of research work using cloud-oriented technologies.

At the initial stage of the experiment, experimental and control groups of students were selected; the method of experimenting was developed; a working hypothesis was formulated; entrance control of the level of development of research competence of students was carried out, which assumes the presence of theoretical knowledge, skills in professional disciplines reflects socio-pedagogical, philosophical-methodological, organizational-methodical, psychological knowledge of the basics of research activities of higher education students, allows to carry out research work, controls stages of scientific knowledge, forms an idea of the logic, structure of scientific research, provides experience of scientific work, etc.

202 students of higher education were involved in the experiment, they were senior year students of bachelor's and master's levels.

Participants of the experimental group (EG) (100 people) were involved in scientific research and active work, they actively participated in scientific competition events: presentations of scientific projects, round tables, seminars, conferences, exhibitions, lectures, debates, intellectual games, Olympiads, meetings with famous scientists, competitions, as well as in other events aimed at stimulating scientific research.

Participants of the control group (CG) (102 people) studied according to the program of the unchanged curriculum. Their scientific and research work was mainly carried out in the process of approbation of research results in scientific publications and during scientific and pedagogical practice.

Our hypothesis consisted of the statement that the result of a high-quality organization of research work in higher education institutions is a high level of research competence formation in students of senior years of bachelor's and master's levels.

To diagnose the level of development of students' research competence, we selected point indicators:

1 point – extremely poorly expressed competence;
2 points – weakly expressed competence;
3 points – moderately expressed competence;
4 points – sufficiently expressed competence;
5 points – clearly expressed competence.

This allowed us to distinguish three levels of formation of research competence.

1–2.5 points – low level of formation of the specified competence: formation of research competence;
2.6–4 points – the average level of development of research competence;
4.1–5 points – high level of development of research competence.

During the research, personal observations of students' preparation for future professional activities, the method of independent characteristics of teachers, conversations, surveys, analysis of practice, self-analysis, observation of students' actions during round tables, training, conferences, resolution of discussions and resolution of pedagogical problems were used. Situations.

A high level of formation of research competence was achieved by:

– 11.3% of EG students;
– 9.1% of KG. These are mostly students who are actively self-developing in the direction of using information technologies, are engaged in scientific work, and have a stable positive attitude toward future professional activities.

Most students are at an average level of research competence development:

– 28.5% of respondents in EG;
– 24.2% of respondents in CG.

At a low level of formation of research competence:

– 60.2% of respondents in EG;
– 64.5% of respondents in CG.

To determine the reliability of the distribution of students into experimental and control groups, according to the results of the experiment, the λ-criterion of Kolmogorov-Smirnov was used, which made it possible to find the point at which there is the largest sum of accumulated differences between the two distributions. The value of the criterion λ is not significant. The empirical distribution of the levels of formation of research competence in the control and experimental groups practically does not differ. This allowed us to conclude the correctness of the division of groups into control and experimental groups.

So, according to the results of the initial stage of the experiment, it was proven that most of the respondents are not motivated for scientific work, are not sufficiently convinced of the need to develop research

competence, do not consider it the most important component of the future profession, and not everyone gets satisfaction from scientific research work.

So, we see that specially organized, purposeful work on the formation of research competence using cloud-oriented technologies, which is current today, is necessary.

At the final and analytical stage of the formative experiment, cloud-oriented technologies and the methods and forms of students' research work developed by us were implemented into the practice of university education; control sections were conducted to identify the level of formation of students' research competence using cloud-oriented technologies. The same methods were used at the initial stage of the experiment. Indicators of the levels of students' research competence in the initial and final analytical stages of the experiment have changed. The results of the research in the experimental group prove that the experimental work contributed to the formation of the research competence of students using cloud-oriented technologies, which are current today. In the control group, the indicators did not increase so significantly:

– 29% of future specialists were identified at a high level in EG, 12.8% in CG;
– At the average level in EG – 45.9% of respondents, in CG – 25.9%;
– At a low level in EG – 25.1% of students, in CG – 61.3%.

After the formative experiment, the obtained results are statistically significant.

Conclusions

The content and main directions of scientific research activity are revealed. The main directions, types of research work, and conceptual tasks of scientific activity in institutions of higher education are highlighted.

The interrelated elements, components, principles, and priority directions of the organization of development and improvement of the effectiveness of scientific research activities of students have been clarified. The need to introduce creative methods and cloud-oriented technologies into the educational process of the higher school, which are aimed at increasing the creative abilities of future specialists, is emphasized.

To check the effectiveness of the organization of students' experimental work, we conducted a pedagogical experiment that lasted during the initial year of 2022-2013 in stages: ascertainment and formative. The purpose of the confirmatory experiment was to confirm the expediency and relevance of research on the chosen topic. The formative experiment consisted of two stages: initial and summary-analytical.

202 students of higher education were involved in the experiment, they were senior year students of bachelor's and master's levels.

Participants of the experimental group (EG) (100 people) were involved in scientific research and active work, they actively participated in scientific competition events: presentations of scientific projects, round tables, seminars, conferences, exhibitions, lectures, debates, intellectual games, Olympiads, meetings with famous scientists, competitions, as well as in other events aimed at stimulating scientific research.

Participants of the control group (CG) (102 people) studied according to the program of the unchanged curriculum. Their scientific and research work was mainly carried out in the process of approbation of research results in scientific publications and during scientific and pedagogical practice.

Our hypothesis consisted of the statement that the result of a high-quality organization of research work in higher education institutions is a high level of research competence formation in students of senior years of bachelor's and master's levels.

To diagnose the level of development of students' research competence, we selected point indicators: During the study, we used our own observations of students' preparation for future professional

activities, the method of independent characteristics of teachers, conversations, surveys, analysis of practice, introspection, observation of students' actions during round tables, training, conferences, resolution of discussions and resolution of pedagogical situations.

To determine the reliability of the distribution of students into experimental and control groups, according to the results of the experiment, the λ-criterion of Kolmogorov-Smirnov was used, which made it possible to find the point at which there is the largest sum of accumulated differences between the two distributions. The value of the criterion λ is not significant.

The empirical distribution of the levels of formation of research competence in the control and experimental groups practically does not differ. This allowed us to conclude the correctness of the division of groups into control and experimental groups.

According to the results of the initial stage of the experiment, it was proved that the majority of respondents are not motivated for scientific work, are not sufficiently convinced of the need to develop research competence, do not consider it to be the most important component of the future profession, and not everyone gets satisfaction from scientific research work. We see that there is a need for specially organized, purposeful work on the formation of research competence using cloud-oriented technologies, which are available today.

At the final and analytical stage of the formative experiment, cloud-oriented technologies and the methods and forms of students' research work developed by us were implemented into the practice of university education; control sections were conducted to identify the level of formation of students' research competence using cloud-oriented technologies. The same methods were used at the initial stage of the experiment. Indicators of the levels of students' research competence in the initial and final analytical stages of the experiment have changed.

The results of the research in the experimental group prove that the experimental work contributed to the formation of the research competence of students using cloud-oriented technologies, which are current today. Indicators did not significantly increase in the control group.

After conducting a formative experiment, we claim that the obtained results are statistically significant.

Our unique research contribution is that for the qualitative organization of scientific and research work in institutions of higher education, we show the ways of forming research competence in students of bachelor's and master's levels.

Proposals for future research are that due to the application of cloud-oriented technologies, higher activity of the participants of the educational process will be achieved, both the effectiveness of the educational activities of the students of education and the level of their research competence will increase. Therefore, the strengthening of requirements for the quality of the training of specialists in institutions of higher education determine the expediency of further theoretical and practical development of this problem, in particular, the study of the possibilities of diversification of methods, forms and technologies that would contribute to the formation of research competence of university students with the help of cloud-oriented technologies, which will become important a step on the way to the professionalism of modern teachers.

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