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Innovative technologies in the development of teachers' professional competence



Tecnologías innovadoras en el desarrollo de la competencia profesional de los profesores

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Abstract

The article analyzes the content of the main concepts of the study and highlights the key types of innovative technologies. It demonstrates the pathways in the process of professional training for modern teachers,



which will allow for the formation of practical experience, the knowledge component necessary for further work in the professional field, and the development of an innovative and effective system for preparing future educators. The main innovative educational technologies necessary for the formation of professional competence in teachers are identified. The role of digitalization in education in shaping teachers' professional competence is clarified; the advantages of using immersive technologies in developing teachers' professional competence are shown. The research-experimental work to study the effectiveness of the formation of professional competence in future teachers through the use of innovative technologies, based on defined pedagogical conditions, was conducted in the following interrelated stages: preparatory stage, diagnostic stage, and formative stage. Students, university lecturers, and school teachers participated in the research-experimental work. The results of the comparative analysis between the diagnostic stage and the formative stage of the experiment demonstrated significant changes in all components of professional competence.

Keywords: professional competence, professional interaction of teachers, students, lecturers, innovative technologies, immersive technologies.

Resumen

El artículo analiza el contenido de los principales conceptos de investigación y destaca los principales tipos de tecnologías innovadoras. Se muestran las formas en que, en el proceso de formación profesional de un docente moderno, brindará la oportunidad de formar experiencia práctica, un componente de conocimiento para el trabajo posterior en el campo profesional y desarrollar un sistema innovador y eficaz de formación de futuros docentes. Se destacan las principales tecnologías educativas innovadoras necesarias para la formación de la competencia profesional de los docentes. Se aclara el papel de la digitalización de la educación en la formación de la competencia profesional de los docentes; Se muestran las ventajas del uso de tecnologías inmersivas en la formación de la competencia profesional de los docentes. Se llevaron a cabo investigaciones y trabajos experimentales sobre la eficacia de la formación de la competencia profesional de los futuros docentes utilizando tecnologías innovadoras basadas en condiciones pedagógicas definidas en las siguientes etapas interconectadas: etapa preparatoria; etapa de verificación; etapa formativa. En los trabajos de investigación y experimentación participaron estudiantes, profesores de instituciones de educación superior y profesores de escuela. Los resultados del análisis comparativo de la etapa de determinación del experimento y la etapa de formación del experimento demostraron que hay cambios significativos en todos los componentes de la competencia profesional.

Palabras clave: competencia profesional, interacción profesional de profesores, estudiantes, profesores, tecnologías innovadoras, tecnologías inmersivas.

Introduction

In the modern global space, the information acquired by individuals is changing at a dizzying pace. Therefore, in the current educational process, it is important to open new horizons through innovative activities, striving to explore unknown information rather than merely accumulating knowledge. There is a growing demand for teachers who are both advisors and inspirers, capable of implementing innovative technologies and breaking away from outdated educational templates. To meet these new demands, teachers must use and consider modern innovative technologies in accordance with widely accepted principles of teaching. Only a creative and flexible mind will enable teachers to quickly achieve results in their professional activities and adapt to the rapid changes constantly occurring in the world. One of the most important tasks in the professional training of future teachers, which pedagogical education faces today, is the application and search for innovative technologies aimed at enhancing the level of professional-pedagogical training of specialists and forming the professional competence of future teachers (Balukh, 2024).



At the current stage of socio-cultural and socio-economic transformations in society, new priorities are driving radical changes through digital technologies and the mastery of Internet resources. This shapes the ability to operate basic settings and provides experience in using new technologies for future professions, particularly in the use of ICT (Information and Communication Technologies) for working with professional materials (Filonenko, 2024).

The goal of forming teachers' professional competence through innovative technologies is to develop a creative and active personality in future professionals, capable of independently using digital technologies to adjust and structure their educational and cognitive activities.

In the global educational space, there has been a shift from traditional learning to hybrid and online learning. Educational institutions, instructors, and teachers in the new conditions of innovative learning are experimenting with novel strategies to engage learners at all levels and enhance their professional orientation through innovative technologies. The digital programs developed by specialists aim to provide students with the best access to classes.

For example, in 2021:

- 57% of all U.S. students had their own digital tools;
- 75% of U.S. educational institutions fully planned to transition to virtual mode;
- 40% of students' device usage was dedicated to educational platforms;
- The use of remote management apps for educational purposes increased by 87%;
- The use of collaboration apps increased by 141%;
- 80% of U.S. universities and schools purchased additional technological tools for learners;
- 98% of universities were teaching online until the end of 2020 (Tran, 2024).

Thus, the presented data highlight the changes in teaching and learning in modern society. Therefore, the main challenge today is the innovative training of specialists who can think creatively – professionals of a new caliber, capable of making unconventional decisions, quickly navigating the modern information space, and continuously developing and learning throughout their lives (Marusynets et al., 2022). The primary tasks of innovative and scientific activities in higher education institutions are to ensure the innovative development of society, acquire knowledge through scientific research and development, direct these achievements toward the implementation and creation of new competitive technologies, and prepare innovative professionals, particularly teachers, who are key to the development of humanity's intellectual potential (Tanska et al., 2024). Therefore, the issue of forming teachers' professional competence through innovative technologies is crucial and necessary in the present day.

Literature Review

To explore the practice of using innovative technologies in the educational process of higher education, we conducted an analysis of scientific research on the formation of future teachers' professional competence through innovative technologies.

O. Komar (2024) reveals the peculiarities of forming digital competence in future primary school teachers for the application of information and digital technologies in mathematics lessons in the context of higher education institutions. It was found that the digital competence of a future specialist, considering the existing opportunities and limitations, involves the ability to independently, responsibly, and purposefully use information and digital technologies in their professional activities. Stages were developed for forming future primary school teachers' readiness to use information and digital technologies in mathematics lessons, with one of the most effective methods being the familiarization of students with educational software tools that are mandatory in primary schools and improving the digital competence of future primary school teachers. The study takes into account organizational, pedagogical, psychological, and methodological factors.



In the formation of professional linguo-cultural competence in future specialists, O. Filonenko (2024) highlights the peculiarities of using information and communication technologies. It was found that in the process of using information and communication technologies, by improving and mastering professional communicative competence, students undergo linguo-cultural integration into the structure of interaction and relationships, within the context of which the individual acquires connections (functional-communicative), which are regulated based on information-technology capabilities, modern methods, forms, and correspond to the demands of linguistic reality and contemporary culture.

M. Balukh (2024), based on the systematization of the experience of training future teachers, proposed innovative health-saving technologies that are effective when used in the educational process of higher education institutions. These include "Runkeeper", "Endomondo", "Nike+GPS", "Adidas miCoach", "My Tracks", "Workout Trainer", "Sports Tracker", "Coaches Eye", "TGFU Games". He demonstrated the significance of applying innovative health-saving technologies in the higher education process, which help develop the professional competence of future specialists, foster positive motivation for self-development, and expand the range of pedagogical skills, knowledge, and interests of future teachers.

A. Kostyk & M. Oliynyk (2024) examined the use of innovative technologies in the professional activities of speech therapists. It has been proven that the purpose of such technologies is to improve corrective and developmental work with children. In overcoming speech disorders in preschool children, these technologies contribute to achieving the maximum possible success, alongside traditional technologies (fairy tale therapy (through the dramatization of fairy tales, role-playing – correction), art therapy (treatment through creativity), aesthetic therapy (impact on personal development through visual arts), pine cone therapy, acorn therapy, sand therapy (tactile impact on the sensory receptors of sand), music therapy (influence through music perception), kinesitherapy (rhythmic – phonetic and speech therapy), etc.).

Zh. Kartashova & M. Kuziv (2024) dedicated their research to the study of innovative approaches, methods, and technologies for teaching music theory disciplines aimed at forming the professional competencies of future music teachers. They analyzed innovative technologies, techniques, and methods used in higher education for training future music teachers. The researchers defined the essence of the concept of "professional competence of the future music teacher" and identified the structural components of professional competence, each characterized by specific indicators: cognitive (ethnocultural and content indicators), personal (indicator of personally significant qualities and communicative indicator), goal-motivational (value-motivational indicator), activity-based (indicator of flexibility in responding to educational changes and creative-activity indicator), and reflexive-forecasting (evaluative-generalizing) indicator.

The research activities of M. Malakhova & O. Ovcharenko-Pieshkova (2024) are also dedicated to this problem, specifically addressing the preparation of future music teachers using innovative technologies to develop students' artistic and creative competencies as a component of cultural competence. It has been proven that the effectiveness of forming the artistic and creative competence of primary school students depends on the level of skills, abilities, and artistic-creative knowledge acquired by future music teachers through innovative educational technologies and their ability to implement these in their professional-pedagogical activities. The researchers conducted a theoretical analysis of the concepts of "artistic and creative competence of students," "preparation of the music teacher," and "teacher training" based on their findings. It was clarified that the artistic and creative competence of a student is a dynamic personal formation based on artistic-creative knowledge, an artistic-aesthetic worldview, and the abilities and capacities of individuals to engage in artistic-creative activities in primary school with a practically valuable attitude. It has been substantiated that the application of health-saving technologies in music lessons – such as music therapy, fairy tale therapy, dance-movement therapy, vocal therapy, etc. – exerts a dual influence on students. These technologies ensure the preservation of personal health, impact the development of artistic-creative abilities, and contribute to the formation of artistic and creative competence. The importance of using time management technologies for effective time organization and the development of independence among future music teachers has been demonstrated, emphasizing their

ability to implement leading methods through innovative technologies in the process of forming students' artistic and creative competencies.

Our analysis of scientific research on the problem of forming the professional competence of future teachers through innovative technologies indicates that the possibilities for improving the training of future teachers are limitless and are rooted in the use of innovative technologies. There is a significant interest among researchers in: revealing the features of forming digital competence in future teachers, developing artistic and creative competence; uncovering ways to apply information and digital technologies in higher education institutions; highlighting the specifics of using information and communication technologies and health-saving innovative technologies, which are effective when used in the educational process of higher education; and exploring innovative approaches, methods, and teaching technologies during the study of professional disciplines to form the professional competencies of future teachers. The analysis of scientific research on the identified problem demonstrates insufficient attention to the practice of using innovative technologies in the higher education process.

Research Aim: to demonstrate the importance and methods of forming the professional competence of teachers through innovative technologies.

Methodology

In the context of this research, the following methods were used: generalization of the experience of professional training for future teachers, analysis of specialized literature and psychological-pedagogical literature, synthesis, and systematization – to develop innovative technologies and methods for forming the professional competence of teachers; generalization and systematization of research materials, which allowed us to identify the state of the problem of applying innovative technologies in education; empirical methods: pedagogical observation, surveys of lecturers, teachers, students, and a pedagogical experiment to verify the effectiveness of the developed pedagogical conditions; methods of mathematical statistics, which we used during the research to establish quantitative dependencies between phenomena and processes and to process the obtained data.

Experimental Research Work aimed at studying the effectiveness of the formation of professional competence in future teachers using innovative technologies was conducted in several interconnected stages: preparatory stage, diagnostic stage, and formative stage.

Participants in the Experimental Research Work included 140 students, 27 lecturers from higher education institutions, and 28 school teachers.

We examined the formation of the professional competence of future teachers through innovative technologies as a dynamic ability of teachers to solve professional tasks in general education, linking it with their future professional-pedagogical activities that encompass the following components: motivational, activity-based, and project-technological.

The level of formation of these components (sufficient, average, high) in the process of solving professional tasks characterizes the effectiveness of teacher professional training.

In the course of the research, we developed pedagogical conditions that ensure the formation of the professional competence of future teachers through innovative technologies.

At the formative stage of the experiment, where respondents were divided into experimental groups (EG) and control groups (CG) and the Student's t-test was used (for independent variables), the statistical verification of incoming control data showed that the CG and EG were homogeneous.

The results of the comparative analysis of the diagnostic and formative stages of the experiment indicated significant changes across all components of professional competence, namely that respondents



in the EG had a higher level of professional competence, achieved better results, and were better prepared to perform professional duties in schools.

The results of surveys conducted among lecturers, teachers, and students of higher education institutions confirmed the effectiveness of the proposed innovations and the implementation of pedagogical conditions that encouraged them to use innovative technologies. The role of lecturers in higher education institutions also changed concerning managing the process of personal development through cooperation and learning, interaction, and examining pedagogical situations through the use of innovative technologies, fostering a creative search for effective solutions to professionally oriented tasks.

Results and Discussion

The content of the main concepts of the research and the main types of innovative technologies.

In our research, we will clarify the concepts of "professional competence of the teacher," "competency-based approach in education," and "innovative technologies."

A derived element of general cultural competence is the professional competence of the teacher. The culture of a person dominates over the competence of the individual, as it encompasses the degree of development and improvement of the personality, including memory and imagination qualities, character, and intellect, which a person acquires during education and upbringing.

The leading pedagogical category that entails the effective creation of certain innovative pedagogical conditions in the educational process is the competency-based approach in education. It is precisely the innovative pedagogical conditions that ensure the formation of the ability to solve professional tasks based on the acquired knowledge, skills, and competencies.

Innovative technologies are defined as a set of methods and tools in the educational process aimed at achieving a predicted outcome, characterized as a process of direct and indirect interaction between students and teachers that ensures personal-oriented interaction. The teacher transforms from a transmitter of scientific information into an organizer of students' cognitive processes, becoming their advisor and assistant (Balalaieva et al., 2023).

In our research, we will adhere to the view that the formation of teachers' professional competence occurs in the higher education process through innovative technologies aimed at a competency-based approach. This approach shifts the focus toward developing and forming the ability of future teachers to creatively apply their acquired experience and knowledge and to act innovatively in practical activities, moving away from merely accumulating standardized skills, abilities, and knowledge.

The complex of three interconnected components constitutes "innovative technology":

1. Active methods for forming teachers' professional competence involve modern teaching methods that engage students in the learning process through interaction rather than relying solely on passive reception of material.
2. Modern content delivered to teachers should foster the development of competencies that align with contemporary business practices, rather than focusing solely on acquiring subject knowledge. It should be presented in the form of well-structured multimedia educational materials.
3. Organizational, technological, informational, and communicative components include a modern learning infrastructure that allows for the effective use of the advantages of distance learning formats.

Today, various pedagogical innovations are applied in the educational process to foster teachers' professional competence. We will highlight the most characteristic and essential innovative technologies (Sulym et al., 2023).

1. Information and communication technologies are essential for forming teachers' professional competence during subject-based education. The content of the educational process involves the implementation of information and communication technologies, integrating various subject areas with computer science, which leads individuals to understand the processes of informatization in society, the informatization of human consciousness, and its professional aspect. The experience of using information and communication technologies in forming teachers' professional competence has shown that:
 - The informational environment of an open-type educational institution significantly increases personal motivation. This environment includes various forms of distance education when studying subject disciplines, especially through project-based learning.
 - Informatization of education alleviates psychological tension in educational communication by transitioning to more objective relationships between "student – computer – teacher", as opposed to subjective relationships between "teacher – student". This increases the share of creative work, enhances work efficiency, and expands opportunities for obtaining additional education, leading to a conscious and purposeful choice of a prestigious career direction in the future.
 - The informatization of teaching enhances personal productivity and increases the overall information culture of educators. Among the main types of digital technologies, the following can be highlighted: cloud technology, mobile learning, gamification, online courses, web quests, etc. (Tran, 2024).

Mobile learning technology is the most popular for forming teachers' professional competence in the field of education. It provides the opportunity for knowledge exchange and productive, convenient collaborative work. Participants in the educational process can share materials remotely using wireless networks, and infrared functions of pocket personal computers can transmit data among mobile devices within a group of learners. Cloud technologies offer convenient network access, allowing for information use with minimal management efforts and enabling the storage of large amounts of information. In other words, the cloud facilitates data processing, distribution, and storage.

2. Information and analytical support for the educational process in forming teachers' professional competence and managing the quality of education for individuals. The information-analytical approach to managing the quality of education is an innovative technology that allows for an unbiased and objective tracking of each teacher's involvement, either individually or as part of a group.
3. Student-centered technologies in forming teachers' professional competence place the student at the center of the entire higher education system. These technologies ensure safe, comfortable, and conflict-free conditions for human development, facilitating the realization of natural potentials. In this approach, the teacher's personality is not merely a means to achieve any abstract goal but is considered the goal of the educational system itself.
4. Monitoring the intellectual development of teachers in forming professional competence involves constructing graphs and testing performance dynamics to analyze and diagnose the quality of each individual's education.
5. The leading mechanism for forming the professional competence of modern teachers is educational technologies, which are an integral factor in current teaching conditions. These technologies involve engaging students in additional forms of personal development, such as participation in creative centers, cultural and mass events, theaters, and national traditions.
6. Didactic technologies, as a condition for forming the professional competence of modern teachers and developing the educational process within an educational institution, provide opportunities to implement well-established techniques as well as new ones – group, differentiated teaching methods, project preparation and defense, games, "consultant" systems, and training using technical means, among others.
7. Psychological and pedagogical support for forming the professional competence of modern teachers involves implementing innovative technologies in the educational process. This includes the use of innovations, scientific-pedagogical justification, analysis with methodological recommendations, seminars, and consultations in the educational field with leading specialists. Innovative teaching



methods for forming modern teachers' professional competence through the introduction of innovative technologies include interactive and dialogic learning, which involves direct communication between students and teachers (Tanska et al., 2024).

Identifying pathways that will enable the formation of practical experience and knowledge components for future work in the professional field during the professional preparation of modern teachers is essential for developing an innovative and effective system for training future educators.

The educational policies of all civilized countries around the world prioritize improving the quality of the modern educational paradigm by transforming traditional teaching methods into innovative technologies, which primarily aid the development of reproductive learning pathways. In contrast, innovative technologies emphasize the formation of creative thinking during classes; actively engaging all participants in the higher education process in cognitive activities; and productively searching for solutions to set tasks. Focusing students' attention on improving and developing fundamental skills is a crucial element of innovative learning, where social skills and productive thinking are directed at establishing interpersonal connections. With this approach, it is important to carry out training consistently at any age to remain competitive professionals in the modern labor market and to acquire professional mobility (Sovhira et al., 2023).

The increase in the prestige of higher education among society in the context of globalization and the reform of higher education is possible through the renewal of the tasks and goals of higher education institutions in accordance with societal values and the modern market's demand for highly qualified teachers. These teachers must be able to quickly adapt to circumstances, possess flexible thinking, have strong communication skills, and have a high level of knowledge. They should not only formulate their thoughts but also confidently express them. Additionally, they should know how to integrate information and communication technologies into the educational space and implement innovative technologies into the higher education teaching process (Holub & Goroshkina, 2023).

Through the education of a new generation of specialists in a particular field, the formation of a future close to ideal is envisioned within higher education institutions. This involves the creation of human capital (skills, abilities, knowledge) and social capital (a stable civic position, mentality, cultural and general values), which will be used for the benefit of the state (Kremen, 2023). The improvement of the educational process in higher education institutions primarily involves the implementation of modernized methods, forms, techniques, and means of teaching during the learning activities, as well as encouraging scientific justification for the proposed innovative teaching technologies.

We emphasize the importance of reorienting towards European standards in the modern educational space while preserving national educational traditions (Leleka et al., 2022).

We emphasize the importance of improving higher pedagogical education, continuous teacher training, analyzing the quality of the educational process, and fostering professionalism and practical skills in educators, as well as the necessity for future teachers to learn how to apply innovative technologies in their lessons.

Addressing the identified issues in the process of professional training for modern teachers allows for the development of practical experience and knowledge components for future work in their professional field; it helps to create an innovative and effective system for training future educators and expands the theoretical and methodological foundations of a student-centered approach to learning. Regardless of the requirements placed on future teachers during their professional training, an important factor is the alignment of their development level with the technological, informational, sociocultural progress, and contemporary ideological trends of modern society, as well as with the traditional canons of the higher education process (Drozich et al., 2023).



We emphasize the necessity and importance of utilizing the principles of organizational development theory in professional competence, which is currently relevant, particularly the tenets of personal self-development theory, to ensure effective collaboration between future teachers and higher education institutions (under the guidance of educators) (Knysh et al., 2023).

The process of professional training for educators, specifically teachers, provides the opportunity to develop practical experience and knowledge necessary for future work in the professional field and to create an innovative, effective system for preparing future educators. It involves nurturing a creative personality capable of self-improvement and self-development, and carrying out productive activities using innovative technologies over an extended period to form and enhance professional competence. This approach will help solidify acquired knowledge, develop quality professional skills in future educators, and enhance the professional competence of teachers through innovative technologies.

Thus, the complexity of forming a teacher's professional competence lies in creating innovative, supportive conditions for the student's potential development, while the result of professional training is determined by the specialist's engagement in the social and educational space, their competitiveness in the modern labor market, which contributes to better motivation and adaptation in society and the professional sphere.

We focused on the fact that during the educational process in higher education, the formation of teachers' professional competence occurs based on personal-oriented, competence-based, and activity-based approaches, which shape the educational environment of the higher education institution, allowing students to practice the relevant skills and knowledge they have acquired in a real environment.

Therefore, it is essential to concentrate on the introduction and search for effective means to reorient the educational process towards European standards for educators for effective modernization of higher education. This process successfully applies the acquired knowledge about forms, approaches, means, methods, and innovative technologies in their practical activities at the teacher's workplace, where the application of innovative teaching technologies is a key element in ensuring a successful educational process, allowing students to acquire personal and professional characteristics.

Innovative educational technologies are new learning technologies that are adapted to the educational space and have emerged in the course of pedagogical activity, or already known technologies that have found applications in new conditions (Shuliak et al., 2022).

The main innovative educational technologies necessary for forming teachers' professional competence.

The main innovative educational technologies necessary for forming teachers' professional competence include:

- **Utilization of the latest advancements in information technology** – to activate kinesthetic, auditory, and visual channels of information perception in the application of computer technologies during classes.
- **Application of the case method in higher education** – involves the teacher using a fictional or real situation to analyze possible developments and serve as a discussion object.
- **Teamwork** – helps develop creative thinking and communication skills during joint activities, involving all participants in the educational process in solving a common problem.
- **Problem-based learning** – facilitates quality assimilation and processing of necessary material and encourages active cognitive activity in students as they independently search for knowledge needed to solve the problem set by the teacher.
- **Games** – involve creating a game environment where the object takes on the role of the teacher in the learning process when it becomes the subject; role-playing simulations of real professional activities in specific situations increase interest in the subject and encourage students to find new ways to solve the tasks set.



- **Learning based on prior experience** – relates students' previous experiences to theoretical information about the subject, allowing for parallels between practical activities and theoretical components.
- **Individual learning** – through the development of educational programs and curricula, allows students to create their own paths to assimilate information that correspond to their capabilities, age characteristics, and interests.
- **Project creation** – involves students developing their own product under the guidance of the teacher in the process of individual or group work, alongside the parallel development of general and specialized professional competencies.

Innovative teaching technologies in modern education aim to activate students' cognitive activities and, through non-standard methods and approaches, reveal their potential (Koval & Masliuk, 2024).

The role of digitalization in education in forming teachers' professional competence.

Educational institutions increasingly apply new innovative educational technologies necessary for forming teachers' professional competence and technologies to improve the quality of education. One of these is the digitalization of education, the digital transformation of the entire educational system and the educational activities of individual higher education institutions (Kulish et al., 2020).

Active use of information and communication technologies characterizes modern education. Information and communication technologies provide students with access to global resources on the Internet; enable computer-based knowledge diagnostics; implement technologies for processing audiovisual information and digital educational tools; and facilitate the creation of new teaching tools within a unified information and educational environment to enhance learning quality.

Modern digital educational resources are characterized by visibility, interactivity, and provide diverse learning information while allowing for objective knowledge assessment, among other things.

In the context of the informatization of education, the creation and use of new teaching tools are relevant. These digital educational resources (information sources) are aimed at achieving the goals and objectives of modern education and contain textual, graphic, speech, video, photo, and other information presented in digital form.

Multifunctional digital educational resources contribute to forming teachers' professional competence, allowing for the placement of large volumes of information; rapid access and search for necessary information; visual presentation of many complex phenomena and processes; and the use of various graphic designs, etc. (Filonenko & Tsukanova, 2023).

The digitalization of education in forming teachers' professional competence provides each student, the future educator, with additional opportunities and quality preparation to develop competencies for professional activity in the following areas:

- Acquisition of the fundamentals of emotional, intellectual, and physical labor activities, practical communication experience, contributing to the formation of professional competence, and the essential intellectual skills necessary for everyday work, self-education, and lifelong learning;
- Acquisition of professional information for forming professional competence, which constitutes the foundation of a person's worldview, contributes to the development of a scientific image of the world, and ensures guidance in choosing the future practical field of activity;
- In accordance with the digitalization of modern society, the formation of teachers' professional competence and the development of the educator's personal potential through the acquisition of creative activity experience (Filonenko, 2024).

With the transition of education to a personalized pedagogy, the current state of forming the professional competence of modern teachers and the entire educational field requires educators to implement innovative technologies, anticipating the development of children's individual abilities and the inclusion of non-traditional methods and approaches in the educational process.

Let's highlight the main tasks for the successful work of a modern teacher:

- To apply innovative technologies for individualized learning trajectories;
- To be knowledgeable about effective modern innovative technologies for forming the professional competence of contemporary educators;
- To be able to combine innovative approaches with traditional ones in their professional activities, drawing on the experience of innovative educators;
- To support the educational process in accordance with established value orientations;
- To implement and develop innovations in working with children;
- To solve pedagogical challenges;
- To create a developmental environment for children's learning using innovative didactic materials;
- To understand how to implement non-standard approaches and new ideas in the process of forming professional competence through innovative technologies;
- To foster a positive climate in the educational community;
- To facilitate communication with other participants in the educational process (parents, children, educators) (Kostyk & Oliynyk, 2024).

Effectiveness and Advantages of Using Immersive Technologies in Forming Teachers' Professional Competence.

With the comprehensive activation of human cognitive activity, there is an increasing involvement of powerful multimedia resources in the rational composition of contemporary disciplinary courses (Tkach, 2017). The effectiveness of using immersive technologies in various forms of the educational process is determined by the profiling of the institution and its educational policy, as well as the configuration of individual educational trajectories, which enhance the quality of programmed learning outcomes with a clarification of specialization (Stratan-Artyshkova et al., 2022).

A tool that contributes to improving the acquisition of learning material today is virtual reality, which takes place in both practical classes and traditional lectures at higher education institutions, as well as in school classrooms. This is a crucial component of innovative education and the formation of modern teachers' professional competence, particularly in the professional development of educational staff.

The new approach to acquiring and delivering practical and theoretical skills in educational institutions of all levels is virtual reality, the application of which in educational settings has important advantages:

- **Increased interactivity of the educational process:** Virtual reality promotes better acquisition of skills and knowledge and allows learners to actively interact with the learning material.
- **Enhanced accessibility of learning:** Virtual reality allows for the creation of simulated situations, providing accessible and safe learning practice (Umanets, 2023);
- **Possibility of simulating real situations:** Virtual reality allows for the creation of realistic simulations for training, such as equipment servicing, medical procedures, flying, and more.
- **Cost reduction:** The use of virtual reality can decrease costs related to infrastructure, equipment, and learning materials, as some training tasks can be virtualized.
- **Increased motivation:** Virtual reality can be engaging and interesting for students, enhancing their motivation to learn. It is important to note that virtual reality cannot replace the teacher in the educational process; its technologies only complement the learning experience.

VR applications improve the effectiveness and motivation of learning and the entire educational process by providing relevant and contextual outcomes to enhance education, helping to focus the user's attention

on specific tasks and allowing teachers to overlay visual effects, information, and various forms of content onto traditional boards, improving student performance (Shetelya et al., 2023).

While working in schools, modern teachers must possess innovative practices to implement innovative teaching models in their practical activities. These include synchronous and asynchronous learning, adaptive learning, blended learning, distance learning, self-directed learning, mobile and cloud learning, flipped classrooms, virtual classrooms, gamification, personalization, e-learning management systems, digital storytelling, and course management systems (CMS), among others. Therefore, special attention should be paid to the digital training of modern teachers.

The professional competence of teachers is fostered by the digital environment (electronic, information-educational environment) of higher education institutions, which includes modern equipment, free Wi-Fi zones, computer labs, electronic learning resources, software, and more.

It is also advisable to utilize created repositories, electronic scientific journals, and electronic readers in higher education institutions for the formation of teachers' professional competence. Additionally, conducting conferences, competitions for student research papers, and seminars in various communication modes can be beneficial.

Moreover, for the formation of teachers' professional competence, additional means of information interaction, such as social networks and discussions of scientific and educational issues in communication chats and interest-based scientific groups, are used. This undoubtedly expands the information educational space of higher education institutions and contributes to the development of teachers' professional competence, ensuring the quality of education in both universities and schools (Kuchai et al., 2022).

We have identified the competency-based approach as one of the main approaches to forming the professional competence of teachers because, in the training of future teachers, this approach facilitates the transfer of practical and theoretical knowledge from the educator to the learner, fostering readiness for professional activity.

The formation of the professional competence of teachers, scholars, and researchers is one of the fundamental components of education development. This includes equipping relevant laboratories, implementing STEM education, supporting future leaders in global science and Hi-tech, and elevating the status of teachers as the professional elite of the nation (Shkarlet, 2022).

The experiment.

In justifying the process of forming the professional competence of teachers through innovative technologies, we focused on the specificity of the research topic, referencing scholars' developments regarding the structure of professional competence and the issues of implementing a competency-based approach and their solutions. We regarded the professional competence of future teachers as a combination of basic professional competencies (reflective, psychological-pedagogical), key competencies (information-communication, communicative), and special competencies (didactic, methodological, subject-specific).

Currently, innovative technologies that are independent of the components and technological, technical, and software environments in which they are implemented need to be integrated into the educational process.

The experimental research aimed at studying the effectiveness of the formation of professional competence in future teachers using innovative technologies based on identified pedagogical conditions was conducted in the following interconnected stages: preparatory stage; ascertaining stage; formative stage.

The experimental study involved 140 students, 27 higher education institution teachers, and 28 school teachers (Fig. 1).

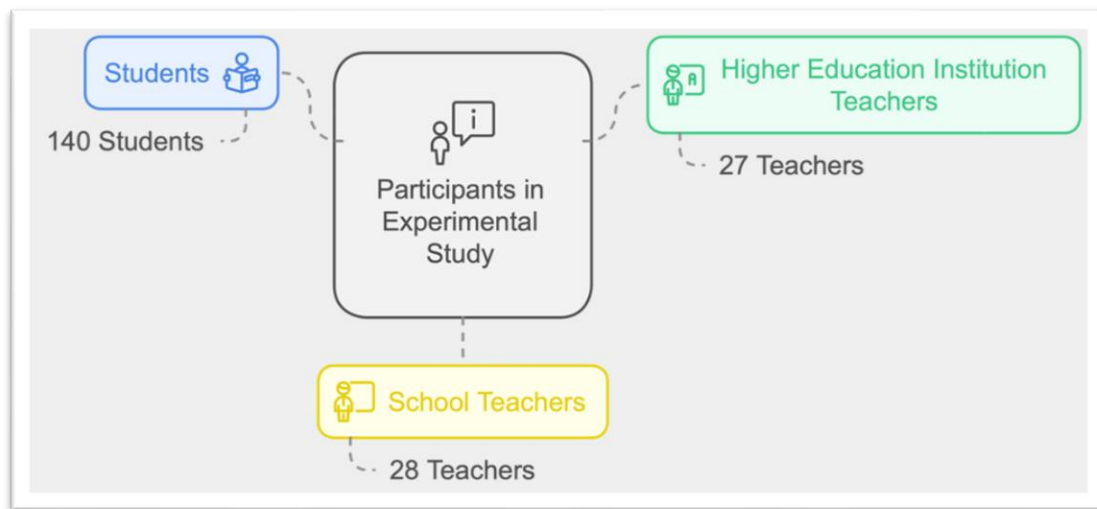


Figure 1. Participants in Experimental Study.

The research into the formation of components – motivational, operational, and design-technological – during the ascertaining stage showed that motivation to form the professional competence of future teachers in each individual is determined by the desire to experience joy from high results and successful activities, driven by internal reasons of the respondents; the quality of education was only 62% among respondents. Only 38% of graduates received satisfactory grades. The average score was 3.7% (Fig. 2).

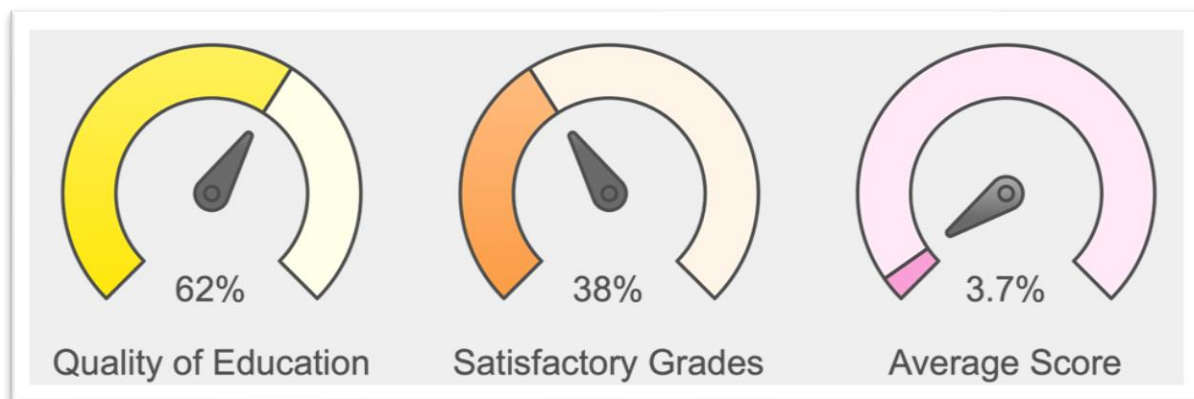


Figure 2. Quality of Education and Graduate Grades.

The analysis of the formation of motivational factors, moral-will, cognitive, organizational components, teaching abilities in educational institutions, and communication skills in pedagogical activity revealed that (Fig. 3):

- 10% of respondents had a high level of formed professional competence;
- 32% of respondents had a medium level of formed professional competence.
- 58% of respondents had a low level of formed professional competence.

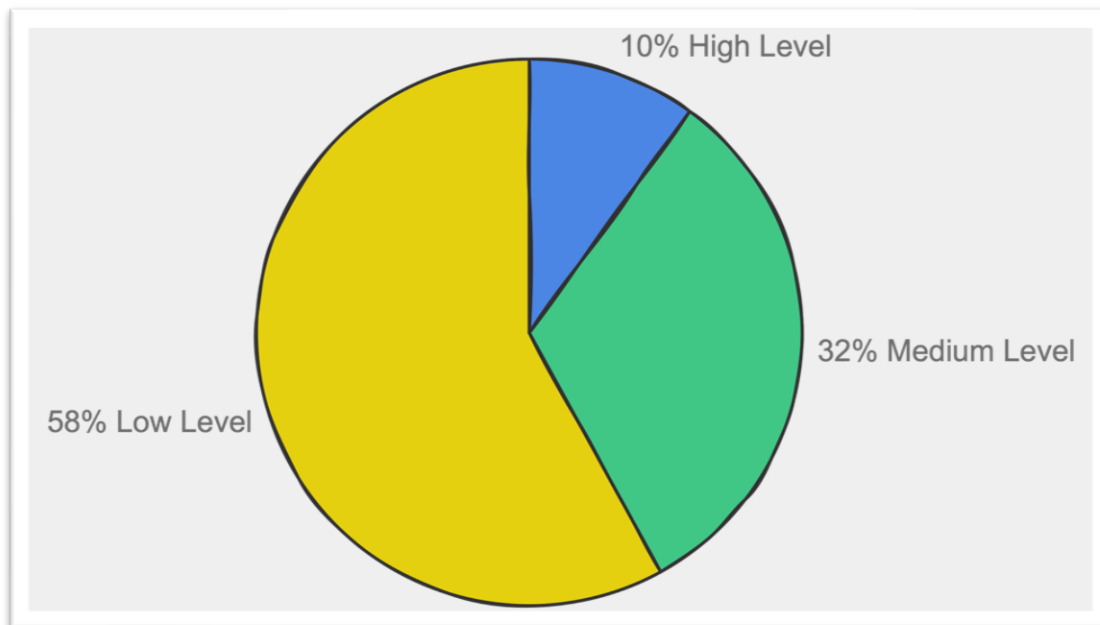


Figure 3. Distribution of Professional Competence Levels Among Respondents.

The results of surveys among higher education institution teachers, students, and school teachers confirmed the insufficient level of professional competence formation in future teachers.

Thus, we concluded that changes in teacher training are necessary.

When effectively utilizing innovative technologies in the educational processes of schools and universities preparing teachers, a crucial aspect is the development of a methodological environment that includes methodological recommendations, instructions for task execution, educational-methodical manuals, etc.

To form the professional competence of future teachers using innovative technologies, we employed the information educational environment of the educational institution, distance learning systems, electronic educational-methodical complexes, blogs, personal web pages, web quests, search engines, cloud technologies, social services, etc.; informational and analytical support for the educational process in forming teachers' professional competence; personality-oriented technologies; monitoring teachers' intellectual development; educational technologies; didactic technologies; and psychological-pedagogical support for the formation of modern teachers' professional competence.

We considered the formation of professional competence in future teachers through innovative technologies as a dynamic ability of teachers to solve professional tasks in general education, with professional-pedagogical future activity combining the following components: motivational, operational, and design-technological.

The level of formation of the specified components (sufficient, medium, high) in the process of solving professional tasks characterizes the effectiveness of teacher professional preparation.

During the research, to address these issues, we developed pedagogical conditions that ensure the formation of future teachers' professional competence using innovative technologies: actualization of the developmental potential of the educational innovative environment of higher education institutions; mastering by teachers the peculiarities of the methodology for forming the professional competence of

future teachers using innovative technologies; and the activation of support for teachers' independent work resources through innovative technologies.

We developed directions for the methodological support of forming the professional competence of future teachers using innovative technologies: engaging teachers, students, and school teachers in actively using innovative technologies in the educational process of educational institutions; enriching databases, knowledge banks; creating complexes (educational-methodical, electronic); developing virtual education; filling information educational systems; developing control methods and interactive teaching methods; monitoring the quality of the educational process; enhancing the qualifications of teachers in applying innovative technologies to form the professional competence of future teachers; and adhering to academic integrity.

In the formative stage of the experiment, where we distributed respondents into experimental groups (EG) and control groups (CG) and applied the Student's t-test (for independent variables), the statistical verification of the initial control data showed that the CG and EG were homogeneous.

The diagnosis of the levels of formation of motivational and operational components involved determining the level of motivation and professional knowledge of both theoretical and practical nature in the process of forming the professional competence of future teachers using innovative technologies. The analysis of the experimental data revealed that the respondents in the EG (with minor differences between the initial control results) demonstrated a significantly greater increase.

The number of respondents with a high level of knowledge in the EG increased from 9% to 18%, and those with a medium level of knowledge increased from 48% to 68%, while the number of respondents with a low level decreased by 29% (in the CG, it only decreased by 7%) (Fig. 4).

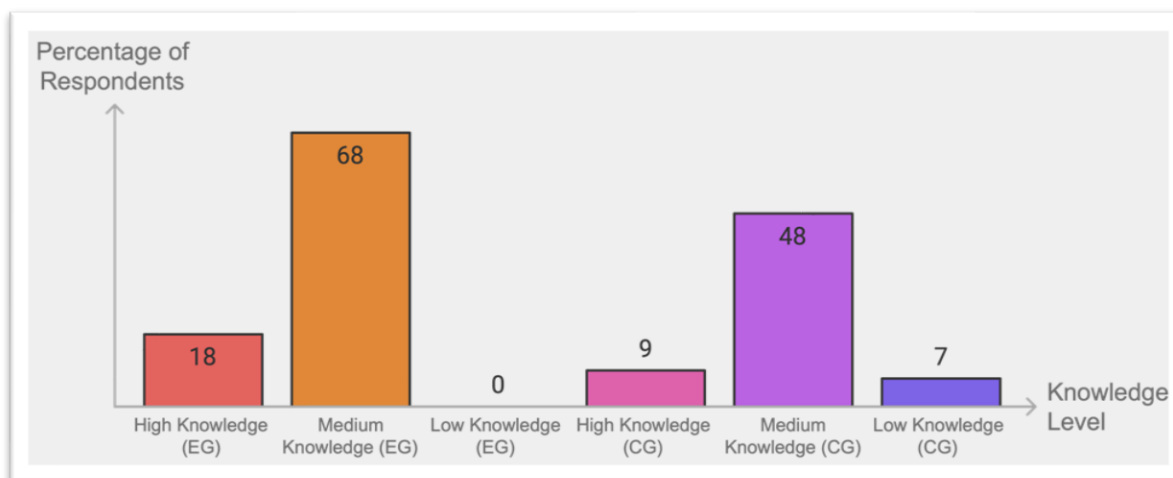


Figure 4. Changes in Knowledge Levels of Respondents.

Statistical verification conducted using the Student's t-test confirmed a significance level of less than 1%, with $df = 108$, $t_{exp} = 2.68$, which lies between $p < 0.001$ (3.381) and $p < 0.01$ (2.621). The research findings indicate that, under the influence of the developed pedagogical conditions, both current teachers and future teachers acquire a higher level of professional competence through innovative technologies.

The study of the level of formation of the design-technological component was based on self-assessment of readiness for self-development and pedagogical assessment by the respondents (showing an 8% increase in high levels in the EG, while the CG showed a 3% increase in high levels; we observed a 19% increase in medium levels in the EG, while the CG had an 11% increase).

The experimental work demonstrated that the use of innovative technologies for forming the professional competence of future teachers based on the pedagogical conditions developed during the experimental work significantly impacted motivation for using innovative technologies; development of prestige motives, communicative and professional motives; awareness of the need to use innovative technologies; interest in forming professional competence through implementing innovative technologies; responsibility for the results of professional activity; and the ability to determine pedagogically appropriate means of innovative technologies, conducting research using innovative technologies; developing and applying innovative technologies in future pedagogical activities.

At the summarizing stage, we summarized the obtained results, processed and systematized experimental data using mathematical statistics methods, formulated conclusions, and identified prospects for further research.

It has been proven that the result of preparing future teachers in higher education using innovative technologies is professional competence that integrates motivational, operational, and design-technological components, reflecting the ability and readiness of teachers to effectively engage in professional-pedagogical activities in schools.

Experimental evidence demonstrates that implementing the developed pedagogical conditions for forming the professional competence of future teachers using innovative technologies in higher education institutions contributes to: activating the reflective position, the educational process; developing self-education skills; enhancing the development of pedagogical abilities and professional interest; increasing teachers' motivation to acquire educational material and apply knowledge; mastering innovative technologies in subsequent professional activities and the methodology of their application; and forming teachers' skills to analyze authors' programs and innovative technology tools, and reasonably choose those that correspond to each individual's level of professional competence.

Comparative analysis results between the ascertaining stage and the formative stage of the experiment confirmed that across all components of professional competence, significant changes were evident, particularly that respondents in the EG possessed a higher level of professional competence, achieved higher results, and were better prepared to fulfill their professional duties in schools.

Results from surveys of teachers, educators, and students from higher education institutions affirm the effectiveness of the proposed innovations and the implementation of pedagogical conditions that encouraged them to utilize innovative technologies. The role of higher education institution teachers has also changed concerning managing the process of personality development through cooperation and learning, interaction, examining pedagogical situations using innovative technologies, and creatively searching for effective solutions to professionally oriented tasks.

Conclusions

An analysis of the content of the main concepts of the research has been conducted, and the main types of innovative technologies have been identified. Pathways have been shown that, in the process of professional training of modern teachers, will enable the formation of practical experience and knowledge components for further work in the professional field and the development of an innovative and effective system for preparing future educators. The main innovative educational technologies necessary for forming the professional competence of teachers have been identified.

The role of digitalization in education in forming the professional competence of teachers has been highlighted, as well as the effectiveness and advantages of using immersive technologies in this process.

Research and experimental work have been carried out to study the effectiveness of forming the professional competence of future teachers using innovative technologies based on defined pedagogical



conditions, which were conducted in three interrelated stages: preparatory stage; ascertaining stage; formative stage.

The experimental work involved students, faculty members of higher education institutions, and school teachers.

The formation of professional competence of future teachers through innovative technologies has been viewed in connection with the dynamic ability of teachers to solve professional tasks of general education, linked to their future professional-pedagogical activities, which combines such components as motivational, activity-oriented, and design-technological.

The level of formation of defined components (sufficient, average, high) in the process of solving professional tasks characterizes the effectiveness of the teacher's professional training.

In the course of the research, pedagogical conditions were developed to ensure the formation of the professional competence of future teachers through innovative technologies.

In the formative stage of the experiment, where respondents were divided into experimental groups (EG) and control groups (CG) and the Student's t-test was used (for independent variables), statistical verification of the incoming control data showed that CG and EG are homogeneous.

The results of the comparative analysis of the ascertaining and formative stages of the experiment indicated that significant changes are observed in all components of professional competence, namely, respondents in the EG have a higher level of professional competence, achieved higher results, and are better prepared to perform professional duties in schools.

The results of surveys of faculty members, teachers, and students of higher education institutions confirm the effectiveness of the proposed innovations and the introduction of pedagogical conditions that encouraged the use of innovative technologies.

Moreover, the role of higher education faculty members has changed concerning managing the process of personal development through cooperation and learning, interaction, examining pedagogical situations through the use of innovative technologies, and creatively seeking effective solutions to professionally-oriented tasks.

Further research and improvement are needed regarding the implementation of open educational resources in the educational process of schools and higher education institutions, the clarification of methods for assessing teachers' readiness for professional activity, and the criteria for the effectiveness of innovative technologies.

Bibliographic references

- Balalaieva, O., Mochan, T., Hryhorenko, T., Andreikova, I., Paltseva, V., & Podkovyoff, N. (2023). Innovative pedagogical technologies – the most important resource in modernizing the training of a modern specialist. *Amazonia Investiga*, 12(63), 67–76. <https://doi.org/10.34069/AI/2023.63.03.6>
- Balukh, M. (2024). Formation of Professional Competence of Future Physical Culture Teachers by Means of Innovative Health Care Technologies. *Pedagogical Discourse*, (35), 19-23. <https://doi.org/10.31475/ped.dys.2024.35.03>
<http://ojs.kgpa.km.ua/index.php/peddiscourse/article/view/1200/1082>
- Drozich, I., Drobin, A., Skrypka, I., Mamchych, O., Mykhailenko, O., & Kurach, M. (2023). The role of education in the innovative society. *Amazonia Investiga*, 12(64), 45–56. <https://doi.org/10.34069/AI/2023.64.04.4>



- Filonenko, O. V. (2024). Formation of linguistic and cultural competence of future specialists using information and communication technologies. *Academic Notes. Series: Pedagogical Sciences*, (215), 96-99. <https://doi.org/10.36550/2415-7988-2024-1-215-96-99>
- Filonenko, O., & Tsukanova, N. (2023). Features of the formation of digital competence of future teachers of primary grades in an institution of higher education. *Pedagogical Sciences: Theory, History, Innovative Technologies*, 8-9(132-133), 155-164. <https://acortar.link/RiGUfb>
- Holub, N., & Goroshkina, O. (2023). Methods of distance learning of the Ukrainian language. *Ukrainian Educational Journal*, (4), 148–158. <https://doi.org/10.32405/2411-1317-2022-4-148-158>
- Kartashova, Zh. Yu., & Kuziv, M. V. (2024). Innovative techniques for the formation of professional competences of future music teachers in the process of studying music–theoretical disciplines. *Pedagogical Academy: Scientific Notes*, (8). <https://doi.org/10.5281/zenodo.12665781>
- Knysh, I., Budanova, O., Vakulenko, S., Syrotina, O., & Popychenko, S. (2023). Innovative educational technologies as a way of higher education enhancement. *Amazonia Investiga*, 12(68), 21–32. <https://doi.org/10.34069/AI/2023.68.08.2>
- Komar, O. A. (2024). Digital competence of the future primary school teacher: preparation for the mathematics lesson. *Academic Notes. Series: Pedagogical Sciences*, (215), 51-55. <https://doi.org/10.36550/2415-7988-2024-1-215-51-55>
- Kostyk, L., & Oliynyk, M. (2024). Modern innovative technologies of corrective work in the professional activities of the speech therapist teacher. *Psychology Travelogs*, (3), 219–228. <https://doi.org/10.31891/PT-2024-3-21>
- Koval, V., & Masliuk, K. (2024). Professional training of future teachers of Ukrainian language and literature using innovative educational technologies. *Youth and Market*, (6), 18-25. <https://doi.org/10.24919/2308-4634.2024.307757>
- Kremen, V. (2023). Teacher training: Challenges and responses: According to the results of scientific report at the meeting of the Strategic Session of the Heads of Higher Education Institutions, March 1, 2023. *Herald of the National Academy of Educational Sciences of Ukraine*, 5(1), 1-6. <https://doi.org/10.37472/v.naes.2023.5104>
- Kuchai, O., Hrechanyk, N., Pluhina, A., Chychuk, A., Biriuk, L., & Shevchuk, I. (2022). World Experience in the Use of Multimedia Technologies and the Formation of Information Culture of the Future Primary School Teacher. *International Journal of Computer Science and Network Security*, 22(3), 760-768. <https://doi.org/10.22937/IJCSNS.2022.22.3.100>
- Kulish, A., Radul, V., Haleta, Y., Filonenko, O., & Karikh, I. (2020). The Newest Digital Technologies in Education and The Prospects of Their Implementation in Ukraine. *Propósitos Y Representaciones*, 8(SPE2), e684. <https://doi.org/10.20511/pyr2020.v8nSPE2.684>
- Leleka, V., Zabiaka, I., Tsviakh, O., Grubi, T., & Vytrykhovska, O. (2022). Innovative approaches to teaching students in the modern educational information environment in the USA and Great Britain. *Amazonia Investiga*, 11(60), 156–166. <https://doi.org/10.34069/AI/2022.60.12.17>
- Malakhova, M., & Ovcharenko-Pieshkova, O. (2024). Preparation of the future teachers in the musical art for the forming of artistic and creative competence of the students by means of innovative technologies. *Current Issues of Humanitarian Sciences*, 2(75), 268-274. <https://doi.org/10.24919/2308-4863/75-2-42>
- Marusynets, M., Vovkochyn, L., Yakymenko, S., Tkachuk, N., & Tymchenko, A. (2022). Innovative educational technologies in the system of specialist's professional training. *Amazonia Investiga*, 11(60), 177–186. <https://doi.org/10.34069/AI/2022.60.12.19>
- Shetelya, N., Oseredchuk, O., Cherkasov, V., Kravchuk, O., Yarova, L., & Kuchai, O. (2023). Competency approach in preparing professionals in an innovative educational environment in higher education. *Revista Conrado*, 19(S3), 298-307. <https://conrado.ucf.edu.cu/index.php/conrado/article/view/3512>
- Shkarlet, S. M. (2022). *Education of Ukraine under martial law. Innovative and project activity: Scientific and methodical collection*. Kyiv-Chernivtsi: Bukrek, 140 p. <https://acortar.link/019jd4>
- Shuliak, A., Hedzyk, A., Tverezovska, N., Fenchak, L., Lalak, N., Ratsul, A., & Kuchai, O. (2022). Organization of Educational Space Using Cloud Computing in the Professional Training of Specialists. *International Journal of Computer Science and Network Security*, 22(9), 447-454. <https://doi.org/10.22937/IJCSNS.2022.22.9.58>



- Sovhira, S., Dushechkina, N., Balokha, A., Borysenko, N., & Iresko, O. (2023). Ecologization of education in the innovative space of higher education. *Amazonia Investiga*, 12(67), 115–126. <https://doi.org/10.34069/AI/2023.67.07.11>
- Stratan-Artyshkova, T., Kozak, Kh., Syrotina, O., Lisnevskaya, N., Sichkar, S., Pertsov, O., & Kuchai, O. (2022). Formation of New Approaches to the Use of Information Technology and Search For Innovative Methods of Training Specialists within the Pan-European Educational Space. *International Journal of Computer Science and Network Security*, 22(8), 97-104. <https://doi.org/10.22937/IJCSNS.2022.22.8.13>
- Sulym, V., Melnykov, A., Popov, M., Vechirko, O., & Malets, D. (2023). Improving education through implementation of information technologies into the educational process. *Amazonia Investiga*, 12(68), 281–293. <https://doi.org/10.34069/AI/2023.68.08.26>
- Tran, E. (2024). *15 innovative teaching methods with guide and examples | Best in 2024*. AhaSlides. <https://ahaslides.com/blog/15-innovative-teaching-methods/>
- Tanska, V. V., Hubarieva, D. V., Androschuk, I. V., Logai, V. A., & Pinchuk, L. M. (2024). Innovative technologies in the modern education system. *Bulletin of Science and Education*, (22), 1494-1508. [https://doi.org/10.52058/2786-6165-2024-4\(22\)-1493-1507](https://doi.org/10.52058/2786-6165-2024-4(22)-1493-1507)
- Tkach, Yu. (2017). VR-technology as a method and means of training. *Educational Discourse*, (3-4), 309-322. <https://od.kubg.edu.ua/index.php/journal/article/download/444/392/1251>
- Umanets, V. O. (2023). Digitalization of educational and administrative processes in vocational (vocation-technical) education institutions. *Science and Technology Today*, 2(16), 321-336. <http://perspectives.pp.ua/index.php/nts/article/download/3822/3843>

