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The importance of information technologies for the formation of digital awareness of educators

La importancia de las tecnologías de la información para la formación de la conciencia digital de los educadores

Maria Kostolovych
Candidate of Pedagogical Sciences, Associate Professor, Associate Professor of the Department of Natural Sciences, Rivne State University of Humanities, Ukraine.
https://orcid.org/0009-0009-2119-6237
kostolovychm@gmail.com
ResearcherID: LRU-4951-2024

Leonid Orshanskyi
Doctor of Pedagogical Sciences, Professor, Head of the Department of Technological and Vocational Education, Ivan Franko Drohobych State Pedagogical University, Ukraine.
https://orcid.org/0000-0001-9197-2953
orshanskilv@gmail.com
ResearcherID: GRX-7823-2022

Qing Liu
PhD Student in Pedagogy, Associate Professor, National University of Life and Environmental Sciences of Ukraine, Ukraine.
https://orcid.org/0009-0006-0783-7171
asp23-q.liu@nubip.edu.ua
ResearcherID: KHY-6500-2024

Viktoriia Imber
PhD in Pedagogical Sciences, Docent of Primary School Department, Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University, Ukraine.
https://orcid.org/0000-0003-2908-9654
imbervika@gmail.com
ResearcherID: AAE-8506-2020

Nadiia Sabat
Candidate of Pedagogical Science, Associate Professor, Department of Social Pedagogy and Social Work, Vasyl Stefanyk Precarpathian National University, Ukraine.
https://orcid.org/0000-0002-0437-6668
nadiya.sabat@pnu.edu.ua
ResearcherID: IAM-0466-2023

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Abstract

The article examines the role of information technologies in strengthening educators' digital competence for professional activities, emphasizing their relevance in shaping professional skills and preparing teachers for the integration of innovative tools in educational contexts. It presents programs and resources for creating interactive online content, such as digital storytelling, as well as international initiatives that encourage the development of a global digital society and promote the adoption of technology in education.

An experimental study was carried out to analyze how educators can be trained to use information technologies effectively and how pedagogical conditions influence this process. The initial phase revealed that most participants had insufficient understanding of pedagogical innovation and underestimated the importance of technology in improving training quality. To overcome this limitation, a methodological support system was developed, which included updated programs, digital content, and a special course designed to foster educators' readiness to employ technology in their professional practice. The findings confirmed the effectiveness of this support, as the experimental group achieved significant statistical improvements in digital competence, while the control group showed only minimal progress related to independent research. The results highlight the importance of structured, technology-oriented training as a crucial factor for advancing professional development.

Keywords: educators, information technologies, professional training, competence, students.

Resumen

El artículo demuestra el papel del uso de las tecnologías de la información en la docencia para desarrollar la competencia digital de los educadores en sus actividades profesionales. Destaca la importancia de las tecnologías innovadoras para el desarrollo de las habilidades profesionales de los educadores mientras se preparan para implementar las tecnologías de la información en su trabajo. También se presentan programas y recursos para la creación de historias interactivas en línea. Además, el artículo examina los principales programas e iniciativas internacionales diseñados para fomentar una sociedad digital en todos los aspectos de la vida, promoviendo la integración activa de las tecnologías de la información en la educación. Se realizó un experimento para explorar el fenómeno de la formación de educadores en el uso de las tecnologías de la información en sus actividades profesionales y para modificar intencionalmente las condiciones de influencia pedagógica en los participantes. El análisis de los resultados de la fase inicial del estudio reveló que la mayoría de los encuestados no comprendía suficientemente los conceptos de innovación pedagógica y no se centraba en la importancia del uso de las tecnologías de la información para mejorar la calidad de la formación profesional. Con base en estos hallazgos, desarrollamos un sistema de apoyo metodológico, cuya eficacia se confirmó con los resultados que mostraron mejoras estadísticas significativas en el grupo experimental. Por el contrario, el grupo de control mostró un progreso mínimo; este avance limitado en el grupo de control tras la prueba inicial se relacionó con las actividades de investigación independientes de los estudiantes.

Palabras clave: educadores, tecnologías de la información, formación profesional, competencias, estudiantes.

Introduction

Practically every aspect of life nowadays is becoming more interactive and digital. Educators must be able to effectively and freely use information technologies, as well as be aware of innovative developments, because every person needs to prepare for life in the information age.

Modern integration of the world community and globalization trends are inevitably affecting various aspects of human existence, especially in the educational sector. Today, the world of education is undergoing modernization and organizational reform. Preparing future educators to utilize information technologies in their professional activities is a continually evolving aspect of their professional training. Traditional approaches to training educators are not always suitable for their specific activities, so the primary scientific task is to develop innovative technologies for educator training, taking into account the ongoing advancement of information technologies.

Preparing future educators of a new type to utilize information technologies in their professional activities is becoming the most crucial prerequisite for the revitalization of global culture, its integration into the European and universal human community, and not just education.

An educator who is in high demand today can apply new knowledge in practice, introduce information technologies into the educational process, and master methods and forms of work to achieve the goal of the highest level of efficiency.

The modernization of education and a shift in the worldview paradigm, as well as the social need for an information society, have determined qualitatively new requirements for the professional competence of future educators (Dwyer et al., 2019). Therefore, the social order of society today requires the training of an educator who has their own personal opinion, feels free in the modern information space, and is capable of self-analysis, mutual learning, self-study, and assimilation of new knowledge regarding the implementation of information technologies in professional activities.

In the context of higher education, it is essential to introduce information technologies that align with the innovative processes unfolding globally today, to modernize the world's education system. The modern market of computer technologies dictates its own requirements for training qualified specialists, which are especially relevant for future educators (Alarcón et al., 2020). The use of information technologies as a means of learning by future educators in their professional activities determines the quality of their professional training. It ensures the readiness of young people for innovative professional activities. (Lee & Bryan, 2025). Therefore, it is necessary to improve and modify the current system of professional training for future educators to address this urgent problem, focusing on the development of readiness among future specialists to utilize information technologies in their professional activities.

Literature Review

The issue of pedagogical innovation in preparing teachers for the use of information technologies in professional activities has been raised in the works of scientists from different countries.

Innovative approaches to teacher self-improvement, including the use of information technologies in professional training, were studied by Rojas López & De La Caridad Ávila Aguilera (2019). The scientists revealed the significance of information technologies in modern pedagogical practice, emphasizing the social need for professional development and the professionalization of teachers in response to the use of information technologies. The problem of training teachers for the use of information technologies in professional activities is considered as a process of adaptive and creative understanding to the extent that teachers teach and research their students.

The issue of pedagogical innovation in preparing teachers for the use of information technologies in their professional activities was raised in their studies by Alonso et al. (2019). The researchers demonstrated the impact of professional experience on the teacher's use of information technologies, as well as its effect on self-improvement and the educational process.

Hernández et al. (2018) define a typology of personality potential in the preparation of teachers for utilizing information technologies in professional activities. The researchers describe the barriers to the integration of information technologies in the perception of higher education teachers, who, during the implementation of innovations, face changes in assessment practices at a Chilean university. The importance of innovative processes utilizing information technologies in professional activities, with integration into pedagogical practice, is revealed.

Information technologies have become a crucial resource in the field of education, an indispensable variable in practice, where the use of resources offered by Web 2.0 is necessary. Therefore, the study by Públio Júnior (2018) deserves attention, where the scientist conducted a critical analysis and revealed the conceptual aspects of preparing teachers to use ICT and their impact on the learning process and on the work of the teacher; the importance of creating pedagogical dimensions that a teacher must possess, which, taking into account new technological trends in education, indicate teaching competencies.

Da Silva et al. (2021) presented and clarified the contribution of information technologies to the professional training of teachers who will work in educational institutions. The study showed that training teachers to use information technologies in professional activities cannot be a lost opportunity to be an agent of transformation; higher education, with the help of information technologies, offers new opportunities for flexible and open learning. When planning the integration of information technologies into the professional training of teachers, it is essential that educational institutions effectively utilize these technologies in their classes, clearly understand the knowledge and skills future specialists should acquire, and assess the extent to which the institution is prepared to integrate information technologies into the curriculum.

At the same time, the problem of training teachers to utilize information technologies in their professional activities remains relevant, necessitating the search for practical tools for improvement and further reflection.

Thus, the relevance and insufficient development of the outlined problem determined the choice of our research topic.

RESEARCH PURPOSE – improving the training of educators in the use of information technologies in professional activities.

Methodology

In the study, to solve the tasks set, various research methods were used:

- **Theoretical**: (synthesis, analysis, comparison, classification, generalization and systematization) − to clarify the essence of the basic concepts of the study, analyze in psychological and pedagogical theory and in practice the state of the problem under study, substantiate the criteria, indicators and levels of readiness of educators to use various information technologies in professional activities, provide content and methodological support for educator training.
- **Empirical**: diagnostic (interview, observation, questionnaire, testing, self-assessment methods) − to determine the state of readiness of educators to use various information technologies in professional activities; generalize their own pedagogical experience, pedagogical experiment (confirmatory stage, formative stage, control stage) − to verify the effectiveness of methodological support for training educators to use various information technologies in professional activities.
- **Statistical** (methods of mathematical statistics) − for analysis, establishment of scientific reliability, and processing of quantitative and qualitative indicators of the experimental study.

The essence of the experiment was to highlight the phenomenon of training educators to use information technologies in their professional activities, and to alter the conditions of pedagogical influence on the respondents purposefully.

From the entire process of professional training for educators, we isolated the methodological component and investigated the aspect of training future educators to utilize information technologies in their professional activities. The factors that will most significantly contribute to the intensification of methodological training for future specialists in higher education institutions within the framework of professional competence development were analyzed.

The practice of organizing the educational process for training future educators at the first (bachelor's) educational level, along with an analysis of scientific sources, revealed a lack of thorough research into the content and methodological support of this process, as well as a deficiency in a methodology for training educators to utilize information technologies.

The need for a pedagogical experiment was determined by the need to address this problem, during which we tested the methodological support developed for training educators to utilize information technologies

in their professional activities, taking into account certain factors that affect the effectiveness of this process. To confirm the statistical significance of the results, they were analyzed.

The purpose of the experiment: to verify the effectiveness of methodological support for the quality training of educators through the use of information technologies.

The task of the experimental study: to experimentally verify the effectiveness of methodological support for the quality training of educators through the use of information technologies and to systematize and analyze the results obtained.

Working hypothesis: Exhibiting the process of training future educators to use information technologies in professional activities will result in signs of systematicity and efficiency if the developed methodological support for this process is implemented.

The experiment assumed the presence of mandatory research components:

- Formation of the goal, objectives, hypothesis, and research problem.
- Distribution of respondents into the experimental group and the control group.
- Selection of methods.
- Analysis of the obtained research results and their mathematical and statistical processing, appropriate measurements, and verification of statistical significance.

During the research process, components (activity, cognitive, motivational), criteria (adaptive, informational, innovative), indicators, and levels of readiness of educators to use information technologies (insufficient, average, sufficient, high) were identified. To determine the state of readiness of future educators to use information technologies, a diagnostic toolkit was developed.

Analysis of the results from the ascertaining stage of the experimental study revealed that most respondents lacked sufficient mastery of the categorical apparatus of pedagogical innovation, and there was a lack of focus in teaching on the importance of utilizing information technologies to enhance the quality of professional training. Additionally, 69% of respondents (mostly students) demonstrated an insufficient level of readiness to use information technologies.

Therefore, based on the data obtained, we have developed methodological support for educators to utilize information technologies, including updated programs for professional disciplines, digital content, and appropriate methodological support, as well as an innovative special course. Each element of the developed support system is designed to form a specific component of the readiness of future educators to utilize information technologies.

The experiment involved adhering to the traditional stages of the study (2023−2025).

The results of both the initial and final (exit) tests administered to the respondents in the control and experimental groups made it possible to determine the level of formation of the respondents' readiness to use information technologies in their professional activities and to draw a general conclusion.

The data obtained during the formative stage of the experiment reflect the dynamics of changes in both the control and experimental groups in percentage terms, indicating significant changes in the levels of formation of EG educators to utilize information technologies in their professional activities.

The dynamics of changes in the readiness of future educators to use information technologies in professional activities were analyzed. It is most significant in the students of the experimental group.

The percentage ratio of qualitative changes of the respondents of the control group compared to the experimental group is less noticeable.

The effectiveness of the proposed training is evidenced by the results obtained, which show statistical changes in the experimental group, indicating the effectiveness of the developed methodological support for preparing future educators to use information technologies in their professional activities. The insignificant progress of the respondents in the control group after the entrance testing is related to the students' independent research activity.

We applied the statistical criterion of homogeneity χ^2 to confirm the reliability of the results revealed in the results of the initial (final) test, the differences between the students of the control and experimental samples, which indicate the effectiveness of the influence of the developed and proposed methodological support for the training of future educators to use information technologies in professional activities in the experimental group of students.

It has been proven that the increase in the results of the initial test, as reported by the respondents in the experimental group, is not accidental. We observe a positive consequence of the proposed methodological support for training future educators to utilize information technologies in professional activities, as well as the identified factors contributing to the effectiveness of general professional training for specialists in higher education.

All of the above contributed to confirming the effectiveness of the hypothesis put forward and achieving the study's goals and objectives.

Results and Discussion

The use of information technologies in education aims to develop educators' digital competence for professional activity

Nowadays, the emergence of innovative forms of learning has been influenced by the informatization of education; however, in this process of innovation and necessity, we cannot deny the effectiveness of the traditional educational trajectory. In the classroom today, the use of information technologies in the educational process, as well as collective, group, and intergroup forms of work, is preferred, which is due to the need to develop interaction skills.

Innovation in the training of future educators involves the introduction of new technologies, in contrast to traditions, which, according to European scientists, consists in stimulating creative and search activities, creating opportunities for specialists to take an active position in the educational process; acquiring their own professional experience, developing critical thinking, using information technologies in teaching and professional activities (Buestán Klein et al., 2024).

The UNESCO recommendations – European Standards define a framework for an educator's digital competence, which includes the following main modules: understanding the role of digital technologies in education, software and hardware tools for digital technologies, pedagogical practices, assessment and curriculum, management and organization of the educational process, and professional development of the educator.

The formation of an educator's digital competence is a dynamic phenomenon. Therefore, the implementation of this innovative factor of the effectiveness of an educator's professional training is possible under the condition of creative education in higher education and systematic advanced training in the field of digital technologies, studying the possibilities of innovative technologies that appear in the world, and ways to implement them in their professional life.

The professional skills of educators are a necessary component of readiness for professional activity and the basis for further selection of information technologies for teaching in the educational process, as they

aim to improve the teaching style, the level of development of cognitive abilities and interests, and mental performance, among other aspects.

Today, acquired competencies serve as indicators that enable the determination of educators' readiness to utilize information technologies in their professional activities, participate in public life, and achieve success and competitiveness in the labor market (Okuonghae, 2025).

As is known, the level of professional competence of an educator determines the competitiveness of a specialist, which is an integral quality of a personality and has its own structure, contributing to self-development and self-improvement (Cárdenas Toledo et al., 2022).

The concept of "competence" is interpreted as a dynamic combination of abilities, skills, knowledge, attitudes, ways of thinking, values, and other personal qualities that determine a person's ability to carry out professional activities and interact successfully in social settings.

The professional competence of an educator is a unified professional and personal characteristic of a person, encompassing both professional and general competencies that optimize professional activities and determine the effectiveness of information technology use in these activities (Fonseca, 2019).

The importance of using innovative technologies for the formation of professional competence of educators in their preparation for the use of information technologies in professional activities. Programs and resources for creating interactive online tasks.

For the development of professional competence among educators in preparing for the use of information technologies in their professional activities, the adoption of innovative technologies is of great importance. A significant innovative technology is the Web-quest, which includes a task that is problematic with elements of a role-playing game. For its implementation, information resources of the Internet are used. The Web-quest justifies its relevance as one of the forms of project activity and distance learning because it diversifies the content of learning, reveals new opportunities, forms, and methods of the educational process, and can be used as a search and research project outside the classroom.

The characteristic features of the Web-quest include individualization, differentiation, variability, and remoteness. The use of this technology in the professional training of educators contributes to the preparation of a competent specialist, as it forms in them information, social, communication, technical, and cultural competence (Geraldi & Bizelli, 2015). The potential of web-quest in preparing educators to use information technologies in professional activities is inexhaustible.

Let's highlight Internet technologies, in particular, programs and resources with which we can create interactive stories online – Storybird, StoryJumper, etc.; tag clouds – WordArt, etc.; flash cards – Barabook, Quizlet, Anki, etc.; comics – ToonDoo, Writecomics, etc.; various tests, quizzes, survey forms – Socrative, Quizalize, Kahoot, Formative, etc.; for simultaneous work in the format of a shared board – Linoit, Padlet, etc.; knowledge maps – Mindomo, Coogle, MindMeister, Mind-mup, Xmind, etc.

The above-mentioned services are designed to facilitate collaboration among all participants in the educational process, including interactive learning, joint work on learning subjects, and shared access. A wide range of resources and software, similar to support, exists today, which helps organize group activities for students during both classroom and extracurricular time. Thus, the use of information technologies, along with interpersonal communication skills and joint activities, enables the development of professional mastery skills in digital technologies (Leal Uhlig et al., 2023).

The global modernization of higher education in the context of integration processes requires taking into account the trends in the development of the higher education system. Let us highlight the main trends in the development of network education:

1. **Informatization of the educational space.** The academic environment of the information society has undergone a significant transformation over the last decade, creating new opportunities for professional education. The modern network space for the "digital generation" appears as a certain virtual reality, in which young people, interacting with users of virtual networks, spend most of their lives receiving the necessary information for their profession and life in the information society. New prospects are emerging for developing one's knowledge and supplementing it through the Internet. Therefore, in the context of the modern information space, the issue of creating a new educational paradigm for the professional training of future educators remains a pressing concern. We recognize the need to develop an academic network paradigm that contributes to the creation of a learning theory in the information environment, enabling the identification of network education's features and promising opportunities for the informatization of higher education.
2. **The orientation of education to an innovative, creative approach.** The development of the ability to invent, design, and conduct research activities in modern higher education is the primary goal of contemporary education, aimed at fostering promising areas of research methodology, creative and relevant developments, and students' independent research skills. The experience of training educators to utilize information technologies in professional activities in developed countries worldwide (Germany, the USA, and Japan) yields significant results. It is precisely those achievements in various fields of science, technology, and education that are reflected in relevant documents of a global perspective.
3. **Strengthening the individualization and differentiation of the information educational process of higher education.** Due to the development of variable educational programs in higher education, this trend is observed. Because academic programs contribute to determining the pace of learning for each student, in relation to their personal and professional qualities, which are oriented towards different categories of future specialists within the context of developing individualized programs. The expansion of individualization and differentiation of learning is envisioned, taking into account the individual trajectory of development for each student, based on the creation of new generations of educational programs.
4. **Lifelong learning of each person.** The orientation of future specialists in the world occurs through the creation of new types of educational institutions of informal education, through the active implementation of the principles of continuous education, which should be taken into account in professional education:

   - Germany, the Netherlands − people's homes.
   - USA − public networks of self-regulated education.
   - Japan − education centers, information and training centers, public halls, etc.

5. **The modeling of educational processes and the trend of technologization of the content of professional education are being traced, which ensures the development of appropriate training courses, innovative competency-based models, and the necessary support of the educational process** (teaching and methodological). In recent years, a number of studies related to the introduction of information technologies have been introduced into the professional training of future educators (Torres-Flórez & Diaz-Betancour, 2021).

In the professional activities of educators, it is necessary to utilize information technologies, which can encompass a wide range of tools, online platforms, and programs that help implement and ensure a high level of interactive modern learning. Here are examples of their effective use as key tools of the educational process:

- **LMS** – Learning Management Systems − student learning management systems. Moodle2, which is distributed free of charge, is a fairly well-known system for creating tasks, organizing training, and testing. It has open-source code for modifying it for specific purposes, allowing you to create tasks, tests, online courses, and evaluate results.

- **Online tools**, such as Google Workspace and Microsoft Office, are a set of programs that allow you to work together, create documents and presentations in cloud services, and communicate (Knysh et al., 2024).
- **Video conferencing platforms** (Microsoft Teams, Zoom, JitsiMeet, etc.), which allow you to communicate in real time, exchange documents, and conduct video conferences, and are a good solution for the educational process in a remote format.
- **Touch projectors and interactive whiteboards serve** as learning tools for the modern educational process and allow for interesting and exciting teaching of material, easy explanation of concepts, and abstract ideas.
- **Specialized programs** (Tinkercad, Code.org, Scratch, etc.) that help design three-dimensional objects, learn the basics of programming, and create animations using a graphical interface.
- **Electronic educational materials and electronic textbooks** provide convenience and accessibility to information, simplify learning, and allow students to quickly adapt to current needs (Manrique-Losada et al., 2020).

International programs and initiatives aim to develop a digital society in all areas of life worldwide, promoting the active integration of information technologies into the educational sector.

The use of information technology in professional activities and educator training is of great importance today for creating effective and engaging classes. This involves the use of web services for creating surveys, tests, interactive boards, and virtual laboratories for studying professional disciplines, among other applications.

An educator must know how to integrate information technologies into the curriculum and professional activities. For example, using the project work method, where there is an opportunity to create multimedia presentations and own websites, is an effective way to train competitive specialists (Forkosh-Baruch & Avidov-Ungar, 2019).

Let's examine various international programs and initiatives aimed at developing a digital society in all spheres of life worldwide, to promote the active adoption of information technologies in the educational sector.

To encourage the active introduction of information technologies in all spheres of digital society, life worldwide, and the development of education, various international programs and initiatives are of great importance (Akyar et al., 2024).

Let us highlight the key initiatives that are worth noting:

1. **Sustainable Development Goals, SDGs** – the UN Sustainable Development Goals, including ensuring access to information technologies, cover a wide range of issues of improving the quality of education to solve global problems. And are an important step towards providing equal opportunities for all population groups and nations to access information technologies in professional activities.
2. **Digital Single Market Strategy** – the roadmap for a homogeneous digital market of the European Union is a strategy designed to create equal conditions in the EU for the implementation of cybersecurity and cyber protection systems for information and network systems, and is aimed at supporting innovations in the field of IT, simplifying access to services and digital products.
3. **Investments in the development of IT technologies of the European Union**. The EU actively invests its resources in the development and research of IT technologies, creating conditions for the advancement of new technologies such as artificial intelligence.
4. **Active cooperation of IT companies with governments and international organizations for the development of digital infrastructure**. Companies such as Facebook, Microsoft, and Google contribute to increasing cooperation with educational institutions and promoting IT literacy. They focus on IT training and academic development.

5. **Global programs and initiatives to protect information systems**. Due to the growing prevalence of cyberattacks and cyber threats, international programs and initiatives have been established to protect information systems. Innovations in education involve creating a learning environment that promotes the practical application of innovative approaches in the training of future educators. It is these innovations that require maximum attention to the content of the future profession and the development of creative, professional competence, subject-methodological competence of both students and educators in preparing young people to use information technologies in professional activities, which is extremely important for meeting the requirements of the modern educational environment and ensuring quality education (Forkosh-Baruch, 2018).

Experimental research methodology.

The essence of the experiment was to highlight the phenomenon of training educators to use information technologies in their professional activities, and to alter the conditions of pedagogical influence on the respondents purposefully.

From the entire process of professional training for educators, we singled out the methodological component. We investigated the aspect of training future educators to utilize information technologies in their professional activities. The factors that, within the framework of the formation of professional competence, will most contribute to the intensification of methodological training of future specialists in higher education institutions were analyzed.

The practice of organizing the educational process for training future educators at the first (bachelor's) educational level, along with an analysis of scientific sources, revealed a lack of thorough research on the content and methodological support of this process, as well as a deficiency in a methodology for training educators to utilize information technologies.

The need for a pedagogical experiment was determined by the need to address this problem, during which we tested the methodological support developed for training educators to utilize information technologies in their professional activities, taking into account certain factors that affect the effectiveness of this process. To confirm the statistical significance of the results, they were analyzed.

The purpose of the experiment: to verify the effectiveness of methodological support for the quality training of educators through the use of information technologies.

The task of the experimental study: to experimentally verify the effectiveness of methodological support for the quality training of educators through the use of information technologies and to systematize and analyze the results obtained.

Working hypothesis: The process of training future educators to use information technologies in professional activities will exhibit signs of systematicity and efficiency if the developed methodological support for this process is implemented.

The experiment assumed the presence of mandatory research components:

- Formation of the goal, objectives, hypothesis, and research problem.
- Distribution of respondents into the experimental group and the control group.
- Selection of methods.
- Analysis of the obtained research results and their mathematical and statistical processing, appropriate measurements, and verification of statistical significance.

The components (activity, cognitive, and motivational), criteria (adaptive, informational, and innovative), indicators, and levels of readiness of educators to use information technologies (insufficient, average,

sufficient, and high) were determined in the research process. A diagnostic toolkit was developed to assess the state of readiness of future educators to use information technologies.

Analysis of the results from the ascertaining stage of the experimental study revealed that most respondents lacked sufficient mastery of the categorical apparatus of pedagogical innovation, and there was a lack of focus in teaching on the importance of utilizing information technologies to enhance the quality of professional training. In addition, 69% (most students) showed an insufficient level of readiness to use information technologies.

Therefore, as a result of the data obtained, we have developed methodological support for the preparation of educators for the use of information technologies (updated programs of professional disciplines, digital content, appropriate methodological support; innovative practical training). Each element of the developed support system is designed to form a specific component of the readiness of future educators for the use of information technologies.

The experiment involved adhering to the traditional stages of the study (2023−2025). Let us describe the tasks of each of the identified stages:

I. Organizational stage of the experiment.

Tasks:

1. Development of criteria and diagnostics of the research apparatus, determination of the level of readiness of future educators for the use of information technologies, and division of students into CG and EG.
2. Development of a methodology for conducting the ascertaining stage of the experiment.
3. Development of methodological support, namely: a special course "Information Technologies of Education in Higher Education" to help students of the first (bachelor's) educational level to provide methodological recommendations on the use of information technologies for internal motivation to use them and a positive attitude towards these technologies; aimed at forming holistic and thorough theoretical knowledge about existing information technologies, their classification, practical skills and abilities of students in the use of information technologies in professional activities and diagnostic apparatus – tasks for testing and questionnaires aimed at determining the level of readiness of future educators to use information technologies.

II. The ascertaining stage of the experiment.

Tasks:

1. Determining the state of readiness of future educators to use information technologies.
2. Theoretical justification and development of methodological support for the preparation of future educators to use information technologies.

III. The formative stage of the experiment.

Tasks:

1. Carrying out an experimental verification of the hypothesis and research methodology.
2. Implementing methodological support for training future educators to use information technologies in EG.
3. Establishing the effectiveness and relevance of implementing the developed methodological support for training future educators to use information technologies in professional activities.
4. Identifying the dynamics of the levels of readiness of future educators to use information technologies.

IV. Control stage of the experiment.

Tasks:

1. Carrying out quantitative and qualitative processing of the data obtained.
2. Verification and analysis of the obtained research results in terms of their statistical significance.

Let us present each of the research stages in more detail.

At the organizational stage of the experimental study, respondents were divided into an experimental group and a control group. Their main parameters were determined, and the absence of differences in the CG and EG was substantiated at the level of statistical significance.

The study involved 160 students, future educators, of the first (bachelor's) educational level, who were divided into CG and EG.

Based on the analysis section, the equivalence of the groups was assessed, which was conducted through an initial test of the level of readiness of future educators to use information technologies, based on the results of the special course "Information Technologies of Education in Higher Education".

Frontal and individual conversations, observations, questionnaires, self-assessments, performance of practical tasks, modular control works, and independent work within the special course were the means of measuring the dynamics of the formation of readiness for future educators to use information technologies, as assessed by the selected components.

The purpose of the ascertaining stage of the experiment was to identify the initial level of readiness of educators to use information technologies by conducting an initial testing of the level of readiness to use information technologies of CG and EG; conducting a questionnaire aimed at identifying motivation, personal priorities, and significance for the use of information technologies; analysis, generalization, processing of the obtained results, verification of the statistical significance of the results. The EG and CG groups consisted exclusively of students of the first (bachelor's) educational level.

It was found during the experiment that (Figure 1):

- 57% of respondents are partially ready to use information technologies in professional activities.
- 11% of respondents are not at all ready to use information technologies in professional activities.
- 72% of respondents have no experience in using information technologies during pedagogical practice.

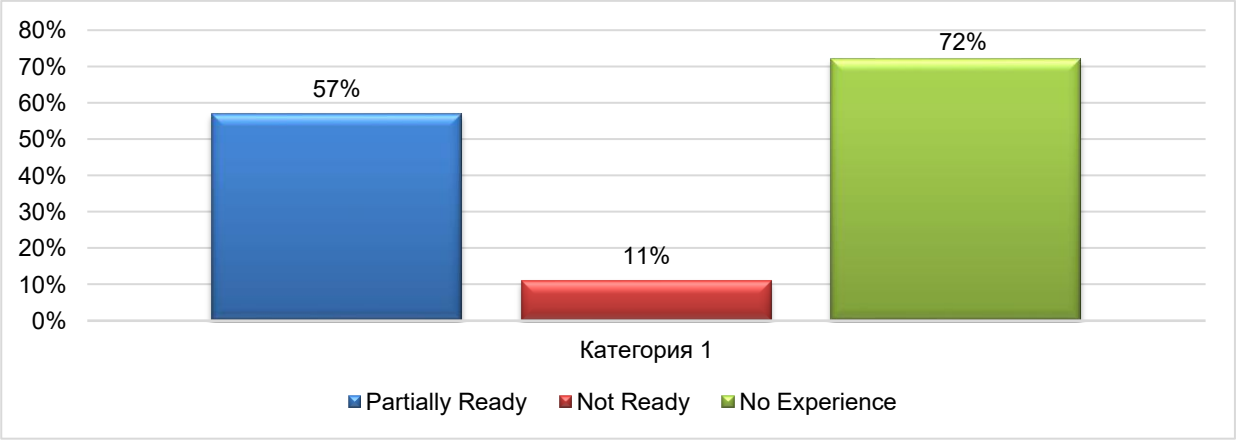

Figure 1. Readiness and Experience with IT in Professional Activities.

The feasibility of targeted work on developing such readiness and the urgency of establishing a separate discipline focused on mastering IT in high schools are highlighted.

Our analysis of the initial state of readiness of future educators to use information technologies in professional activities revealed the need to develop methodological support and modeling of the process of training educators to utilize information technologies in their professional activities, making it possible to transition to the formative stage of the experiment.

We note that the training of students in the control group was carried out according to the traditional system, taking into account standard curricula, under the conditions of using conventional means of organizing the educational process and methods, and among students in the experimental group, the training of future specialists was carried out in accordance with the developed methodological support, taking into account certain factors of the effectiveness of the implementation of the proposed methodology for training educators to use information technologies, in particular, the formation of EG components (motivational, cognitive and activity) of future educators to use information technologies in students.

The purpose of the formative stage of the experiment was to confirm the effectiveness of the developed methodological support for training educators to use information technologies in professional activities.

The formative stage of the experiment was based on the material developed for the digital content, the special course "Information Technologies of Education in Higher Education," and on the implementation of an innovative workshop with appropriate methodological support.

The special course "Information Technologies of Education in Higher Education" aimed to develop practical skills and abilities, as well as holistic, thorough, and systematic theoretical knowledge, and to organize classes using information technologies.

As a result of studying the special course, students acquired the skills to correctly and methodically apply information technologies in classes; in accordance with the applied information technologies, to carry out control and self-control of academic performance, to conduct analysis and self-analysis of classes in professional disciplines using information technologies; to independently search for information by introducing information technologies, to work with recommended literary sources.

The following leading teaching methods were applied to the students of the experimental group: interactive, information, multimedia technologies, problem-solving, distance learning, training, project-based learning, case studies, European portfolio, block-based digital learning technologies, multimedia, computer-based learning, and mobile learning technologies.

The purpose of the control stage of the experiment was to conduct cross-sectional analyses in the experimental and control groups of respondents, which made it possible to track the dynamics of the levels of readiness of future educators to use information technologies and evaluate qualitative changes in these indicators. Therefore, the effectiveness of the proposed methodological support for the training of educators to use information technologies was tested. Thanks to the application of mathematical statistics methods at this stage, it became possible to analyze, process, and establish the scientific reliability of qualitative and quantitative indicators of the experimental study.

It should be noted that the effectiveness of the impact of the developed methodological support for the training of educators for the introduction of information technologies on the level of their readiness is evidenced by the results of the control stage of the experimental study.

We are referring to the positive dynamics in the experimental group, which were revealed using the proposed self-assessment card and demonstrated by the students' independent assessment of their own readiness for the introduction of information technologies. The obtained quantitative indicators indicate the effectiveness of the proposed methodological support for the training of educators, which is reflected in the

self-assessment of the level of readiness of future educators for the introduction of information technologies.

The proposed options for answers to the self-assessment card are consistent with the determined levels of readiness for the introduction of information technologies:

- A high level of the indicated readiness corresponds to the answer option “fully ready”.
- An average level of the indicated readiness corresponds to the answer option “sufficiently ready”.
- A sufficient level of the indicated readiness corresponds to the answer option “partially ready”.
- An insufficient level of the indicated readiness corresponds to the answer option “not at all ready”.

We have investigated that (Figure 2):

- 15% of EG students assess their own level of readiness for the introduction of information technologies as high.
- 56% of EG students assess their own level of readiness for the introduction of information technologies as average.
- 26% of EG students assess their own level of readiness for the introduction of information technologies as sufficient.
- 3% of EG students assess their own level of readiness for the introduction of information technologies as insufficient.

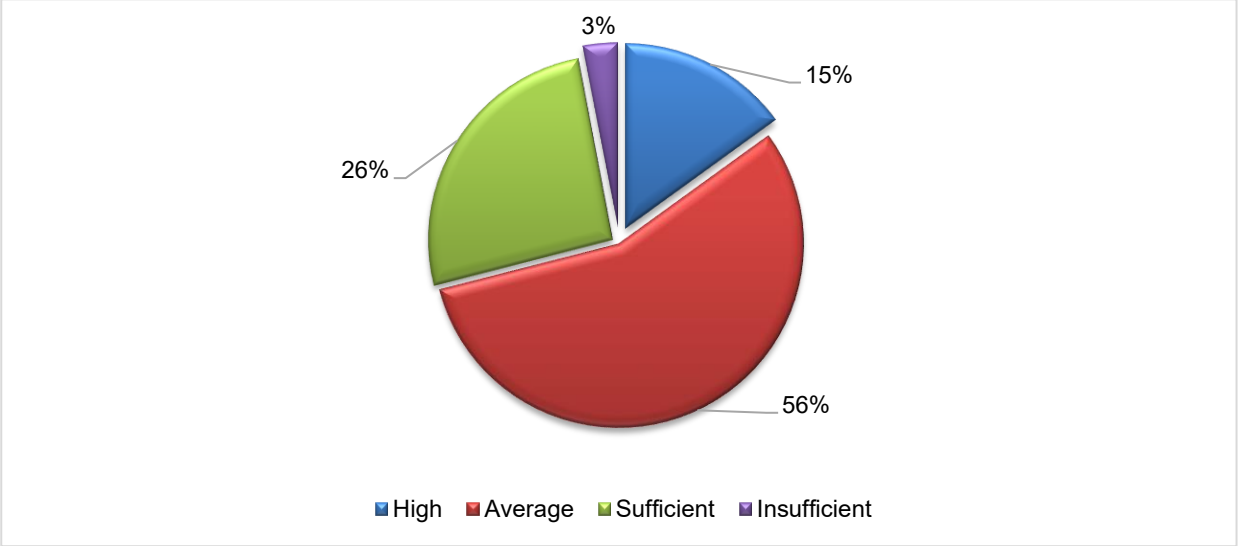

Figure 2. EG Students' Readiness for IT Introduction.

The results of the self-assessment of the control group are not representative.

Analysis of the results of the experimental verification of the methodological support for the training of educators for the introduction of information technologies.

At the ascertaining stage of the experiment, we determined the state of readiness of future educators to introduce information technologies.

The results obtained demonstrated that about 80% of respondents have a high level of interest in information technologies, ways of their introduction into professional activities, and modernization of the learning process through the use of information technologies, which indicates the presence of motivation

of respondents to master information technologies, which confirms the partial formation of the motivational component of readiness among respondents.

Self-analysis of the participants of the experiment showed that 70% of respondents during the internship had no experience in using information technologies at all, 11% were not ready to use information technologies in professional activities, 57% of respondents were partially prepared, therefore they indicated the feasibility of targeted work on the formation of such readiness, and this showed the need for an experimental study of the formation of the activity and cognitive components, because the lack of formation of the specified components was proven.

We employed an effective diagnostic method, testing during the formative stage of the experimental study. The entrance test we proposed aimed to determine the initial level of readiness for using information technologies among the control and experimental groups of respondents before the experiment began, assessing their basic skills, abilities, and knowledge in this area.

The test results determined the nature of the distribution of students (in terms of statistical significance, 0.05) by the initial level of readiness of future educators to use information technologies in the control and experimental groups.

Random samples of 35 people (m = 35) were formed using a random sampling method – each of the control and experimental groups of respondents, respectively, to implement the set goal.

The null hypothesis of the study was determined as follows: the indicators in the control and experimental groups of respondents, before the introduction of training, at the level of statistical significance ($p < 0.05$), were found to be statistically equivalent in terms of readiness for the use of information technologies.

We calculated the results of the entrance testing for respondents in the control group of a random population using a similar principle. As in the experimental group, the number of participants was 35 people (m = 35).

To confirm and test the hypothesis of the coincidence of the characteristics of respondents in both groups, the Cramer-Welch criterion was applied, which is the most optimal under the given conditions, namely, it was based on the volume of random populations, calculated variances, and average scores.

We conclude that the characteristics of the sample populations of the control group and the experimental group at the 0.05% significance level before the start of the experiment coincide, because the obtained empirical value of the Cramer-Welch criterion $T_{emp} = 0.03$, and $T_{emp} \leq T_{crit}$ ($T_{0.05} = 1.96$).

We conclude that the characteristics of the populations of the experimental group and the control group (all participants in the experiment) are similar, as the specified sample populations were formed through random sampling of elements.

We empirically established the levels of readiness of future educators to use information technologies, based on the principle of distribution into four equal intervals of the score scale, each representing 100% of the score scale.

Considering that the students of the EG and CG before the beginning of the experimental training had an overall insufficient level of readiness to use information technologies in professional activities and none of the respondents of the control and experimental groups had a high level, which indicates the need to carry out work in the context of professional training of educators, improving the quality of the methodological component, we in the experimental group developed a methodology and a special course for the high-quality training of future educators in the use of information technologies.

Following the introduction of innovations, a comparative final test was conducted with the respondents from the control and experimental groups. The purpose of testing at this final stage of the study is to identify statistically significant changes in the experimental group that can be attributed to the impact and effectiveness of the developed methodology, which includes a special course to train educators in the use of information technologies in their professional activities.

The initial testing enabled us to obtain results that clearly demonstrated the reliability of the differences and identities between the levels of readiness for using information technologies in the professional activities of educators in the control group and the experimental group of respondents, at a level of statistical significance of 0.05.

Thus, the Null Hypothesis was determined: students in both the control group and the experimental group, after completing experimental training only in the experimental group (at a level of statistical significance of 0.05), differed in their levels of readiness for using information technologies in professional activities.

For the initial (final) test of the levels of readiness for the use of information technologies by educators, the empirical value of the Kramer-Welch criterion: Tempo final = 0.98.

Since the critical value of the Cramer-Welch criterion is T_{crit} = 1.96, and the selected level of statistical significance is − 0.05, we obtained the following result: $T_{emp} \leq T_{crit}$ ($T_{0.05}$ = 1.96). Therefore, we conclude that the characteristics of the sample sets in both the experimental group and the control group are statistically significant at the 0.05% level. The sample sets for the control group and the experimental group of respondents were formed using random sampling. Therefore, we are talking about the entire set of participants in the experiment.

The results of both the input and the final (output) test by the respondents of the control group and the experimental group made it possible to determine the level of readiness of the respondents to use information technologies in professional activities and to draw a general conclusion.

The obtained data reflect the dynamics of changes in the control group and the experimental group in percentage terms, indicating significant changes in the levels of formation of EG educators to utilize information technologies in professional activities.

Let us analyze the dynamics of changes in the levels of readiness of future educators to use information technologies in their professional activities. This is particularly significant for students in the experimental group.

After experimental training, the percentage ratio of respondents of the experimental group was as follows (Figure 3):

- The high level of formation of readiness of future EG educators to use information technologies in professional activities increased by 39%.
- The sufficient level of formation of readiness of future EG educators to use information technologies in professional activities increased by 34%.
- The average level of formation of readiness of future EG educators to use information technologies in professional activities decreased by 18%.
- The insufficient level of readiness of future educators of the EG to use information technologies in professional activities decreased by 55%.

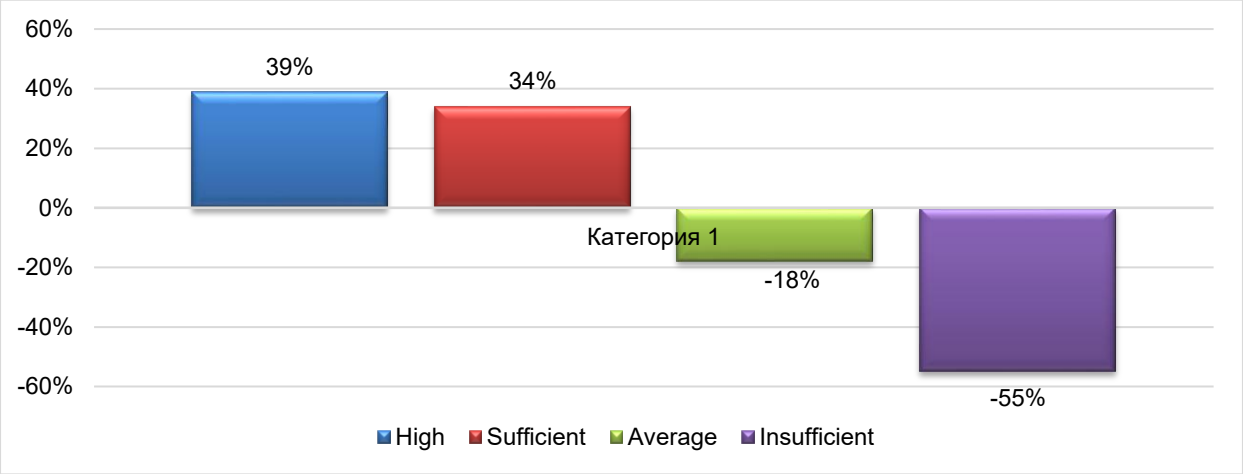

Figure 3. Changes in Readiness Levels of Educators (EG).

The percentage ratio of qualitative changes of respondents of the control group compared to the experimental group is less noticeable (Figure 4):

- The high level of readiness of future educators of the CG to use information technologies in professional activities increased by only 3%.
- The sufficient level of readiness of future educators of the CG to use information technologies in professional activities increased by 3%.
- The average level of readiness of future educators of the CG to use information technologies in professional activities increased by 2%.
- The insufficient level of readiness of future educators of the CG to use information technologies in professional activities decreased by 7%.

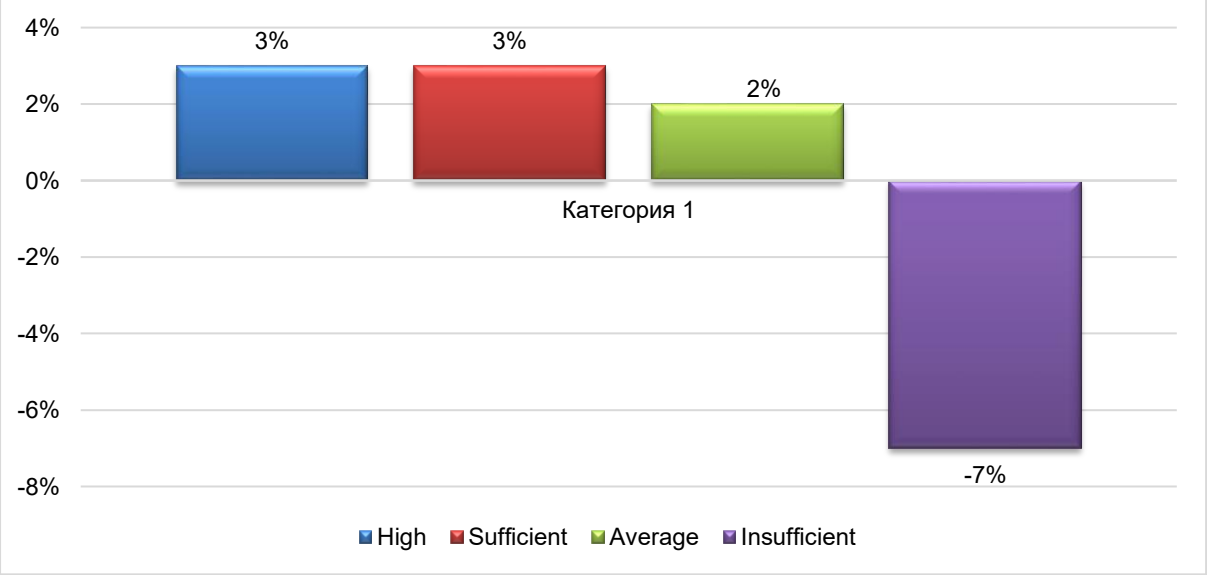

Figure 4. Changes in Readiness Levels of Educators (CG).

The effectiveness of the proposed training is evidenced by the results obtained, which showed statistical changes in the experimental group, indicating the effectiveness of the developed methodological support for the training of future educators to use information technologies in professional activities.

The insignificant progress of the respondents in the control group after the entrance testing is associated with the independent research activities of the students.

Changes in the increase in the relative number of respondents by the levels of readiness of future educators to use information technologies in professional activities were distributed as follows:

- The difference at a high level in the control group and the experimental group was − 36%.
- The difference at a sufficient level in the control group and the experimental group was − 31%.
- The difference at an average level in the control group and the experimental group was − 20%.
- The difference at an insufficient level in the control group and the experimental group was 48%.

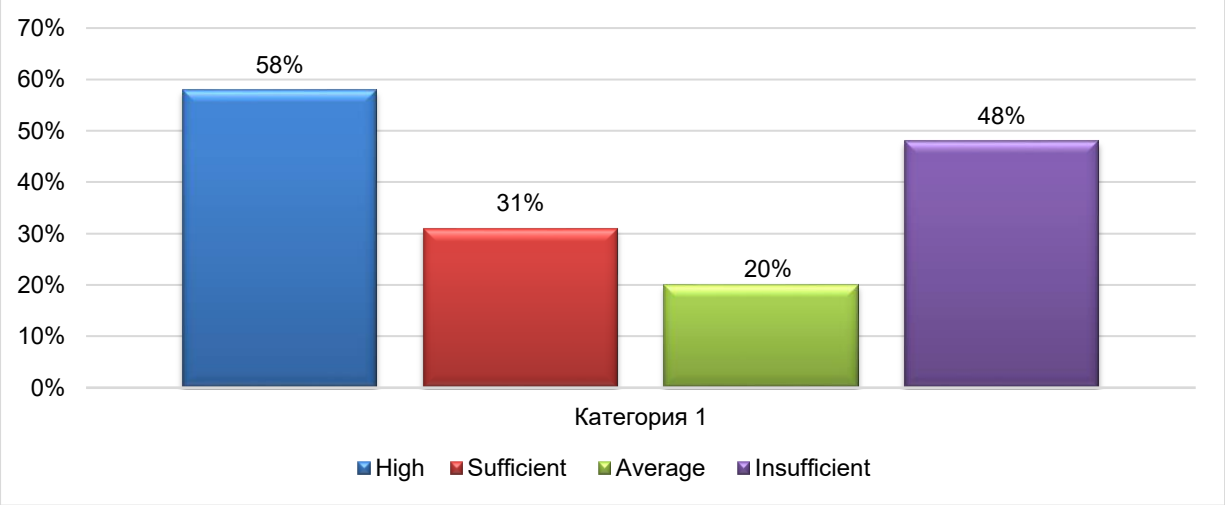

Figure 5. Differences in the levels of readiness of future educators to use information technologies (EG vs. CG).

The difference at a high level between the control group and the experimental group was 37%, which indicates the effectiveness of the developed methodology, organization of training, and choice of forms, methods, and approaches, as well as the effectiveness of the proposed special course and experimental program in the EG.

We applied the statistical criterion of homogeneity χ^2 to confirm the reliability that the differences found in the results of the initial (final) test by students of the control and experimental samples indicate the effectiveness of the impact of the developed and proposed methodological support for the training of future educators to use information technologies in professional activities in the experimental group of students. Using the example of the already defined random populations of the control and experimental groups in the experiment, specifically 35 people, the calculation was carried out.

Let us determine the empirical value of the criterion of homogeneity after the completion of experimental training for the control and experimental sample populations. $\chi^2_{emp} = 36.698$. The characteristics of all compared sample populations, except for the control and experimental groups after the experiment, the experimental group before and after the experiment, the experimental group after the completion of experimental training, and the control group before the experiment, coincide at the level of statistical significance ($p < 0.05$). The empirical values of the comparison of the sample sets of the control and experimental groups of the criterion of homogeneity χ^2 after the completion of the experimental training program are greater than the critical value $\chi^2_{0.05} = 9.49$. This indicates the reliability, after the completion of the experimental training, of the characteristics of the specified compared sample sets, and is 95%.

Therefore, the increase in the results of the initial test performed by the respondents of the experimental group is not accidental. We observe a positive consequence of the effectiveness of the proposed methodological support developed by us for training future educators to utilize information technologies in their professional activities, as well as the identified factors contributing to the effectiveness of general professional training for specialists in higher education.

All of the above contributed to confirming the effectiveness of the hypothesis put forward and achieving the study's goals and objectives.

Conclusions

The role of information technologies in education is demonstrated to develop the digital competence of educators for professional activities. The importance of utilizing innovative technologies in developing professional competence among educators, particularly in their preparation for integrating information technologies into professional practice, is highlighted. Programs and resources for creating interactive online stories are presented.

The main trends in the development of network education are highlighted in connection with the global modernization of higher education in the context of integration processes, which requires taking into account the trends in the development of the higher education system.

It has been proven that in the professional activities of educators, it is necessary to utilize information technologies, which can encompass a wide range of tools, online platforms, programs, and technological solutions that help implement and ensure a high level of interactive modern learning. Examples of their effective use as key tools of the educational process are given.

The main international programs and initiatives for developing a digital society in all spheres of life worldwide were analyzed to encourage the active introduction of information technologies into the educational sector.

An experiment was conducted, the essence of which was to highlight the phenomenon of training educators to use information technologies in professional activities and to alter the conditions of pedagogical influence on respondents intentionally.

From the entire process of professional training for educators, we singled out the methodological component. We investigated the aspect of training future educators to utilize information technologies in their professional activities. The factors that, within the framework of the formation of professional competence, will most contribute to the intensification of methodological training of future specialists in higher education institutions were analyzed.

The practice of organizing the educational process for training future educators at the first (bachelor's) academic level, along with an analysis of scientific sources, revealed a lack of thorough research into the content and methodological support of this process, as well as a deficiency in a methodology for training educators to utilize information technologies.

Analysis of the results from the ascertaining stage of the experimental study revealed that most respondents lacked sufficient mastery of the categorical apparatus of pedagogical innovation, and there was a lack of focus in teaching on the importance of utilizing information technologies to enhance the quality of professional training. Additionally, 69% of respondents (mostly students) demonstrated an insufficient level of readiness to use information technologies.

Therefore, based on the data obtained, we developed methodological support for educators to utilize information technologies, including updated programs for professional disciplines, digital content, and appropriate methodological support, as well as an innovative special course. Each element of the

developed support system is designed to form a specific component of the readiness of future educators to utilize information technologies.

The results of both the input and final (exit) tests administered to respondents in the control group and the experimental group made it possible to determine the level of readiness of respondents to utilize information technologies in their professional activities and to draw a general conclusion.

The data obtained during the formative stage of the experiment reflect the dynamics of changes in both the control and experimental groups in percentage terms, indicating significant changes in the levels of EG educators' use of information technologies in professional activities.

The dynamics of changes in the readiness levels of future educators to use information technologies in professional activities were analyzed. It is most significant in students of the experimental group.
The percentage ratio of qualitative changes of respondents of the control group compared to the experimental group is less noticeable.

The effectiveness of the proposed training is evidenced by the results obtained, which show statistical changes in the experimental group, indicating the effectiveness of the developed methodological support for training future educators to use information technologies in their professional activities. The insignificant progress of the respondents in the control group after conducting the entrance testing is associated with the independent research activities of the students.

It is proven that the increase in the results of the initial test revealed by respondents of the experimental group is not accidental. We observe a positive consequence of the proposed methodological support for training future educators to utilize information technologies in professional activities, as well as the identified factors contributing to the effectiveness of general professional training for specialists in higher education. All of the above contributed to confirming the effectiveness of the hypothesis put forward, thereby achieving the study's goals and objectives.

The presented study does not exhaust all the problems associated with preparing future educators for the use of information technologies in professional activities; therefore, the need for further research is to study the foreign experience related to the outlined problem.

Bibliographic references

Akyar, B. C., Monteiro, A., & Fernandes, P. (2024). Exploring Portuguese preschool educators' attitudes and practices on information and communication technology (ICT). *Education and Information Technologies, 29*, 19299–19320. https://doi.org/10.1007/s10639-024-12613-2

Alarcón, R., Jiménez, E. D., & de Vicente-Yagüe, M. I. (2020). Development and validation of the DIGIGLO, a tool for assessing the digital competence of educators. *British Journal of Educational Technology, 51*(6), 2407–2421. https://doi.org/10.1111/bjet.12919

Alonso, R. R., Plaza, I. R., & Orfali, C. H. (2019). Barriers in teacher perception about the use of technology for evaluation in higher education. *Digital Education Review*, *(35)*, 170–185. https://doi.org/10.1344/der.2019.35.170-185

Buestán Klein, M. A., Bermeo Pazmiño, K. V., & Rivera Costales, J. A. (2024). Impacto de la responsabilidad social corporativa en el ecosistema digital de las instituciones de Educación Superior del Ecuador. *Revista Conrado, 20*(101), 141–150. Recuperado a partir de https://conrado.ucf.edu.cu/index.php/conrado/article/view/4152

Cárdenas Toledo, C. A., Barba-Guaman, L., Loaiza, M. I., & Validiviezo-Diaz, P. (2022). Use of clustering techniques in the search for innovative teacher characteristics. In *2022 17th Iberian Conference on Information Systems and Technologies (CISTI)* (pp. 1–7). IEEE. https://doi.org/10.23919/CISTI54924.2022.9820569

da Silva, R. J., Tommasetti, R., Gomes, M. Z., & Macedo, M. A. da S. (2021). Accountants' IT responsibilities and competencies from a student perspective. *Higher Education, Skills and Work-Based Learning, 11*(2), 471–486. https://doi.org/10.1108/HESWBL-02-2020-0028

Dwyer, A., Jones, C., & Rosas, L. (2019). What digital technology do early childhood educators use, and what digital resources do they seek? *Australasian Journal of Early Childhood, 44*(1), 91-105. https://doi.org/10.1177/1836939119841459

Fonseca, G. R. (2019). As tecnologias de informação e comunicação na formação inicial de professores do 1º ciclo do ensino básico – fatores constrangedores invocados pelos formadores para o uso das tecnologias. *Educ. Form., 4*(11), 3–23. https://doi.org/10.25053/redufor.v4i11.254

Forkosh-Baruch, A. (2018). Preparing preservice teachers to transform education with information and communication technologies. In *J. Voogt, G. Knezek, R. Christensen, & K. W. Lai (Eds.), Second handbook of information technology in primary and secondary education* (pp. 1–20). Springer. https://doi.org/10.1007/978-3-319-71054-9_28

Forkosh-Baruch, A., & Avidov-Ungar, O. (2019). ICT implementation in colleges of education: A framework for teacher educators. *Journal of Information Technology Education: Research, 18*, 207–229. https://doi.org/10.28945/4312

Geraldi, L. M. A., & Bizelli, J. L. (2015). Tecnologias da informação e comunicação na educação: conceitos e definições. *Revista on Line de Política e Gestão Educacional*, *(18)*, 115–136. https://doi.org/10.22633/rpge.v0i18.9379

Hernández, R. M., Orrego Cumpa, R., & Quiñones Rodríguez, S. (2018). Nuevas formas de aprender: La formación docente frente al uso de las TIC. *Propósitos Y Representaciones, 6*(2), 671–701. https://doi.org/10.20511/pyr2018.v6n2.248

Knysh, I., Drobin, A., Filimonova, T., Koycheva, T., Kushnir, A., & Kuchai, O. (2024). The use of information technologies in the educational space of Ukraine (on the example of STEAM technologies). *Revista Conrado, 20*(100), 437–448. https://conrado.ucf.edu.cu/index.php/conrado/article/view/3979

Leal Uhlig, E. F., Garza León, C., Cruz Vargas, X., Hernández Franco, S., & Portuguez-Castro, M. (2023). Lëttëra web platform: A game-based learning approach with the use of technology for reading competence. *Frontiers in Education, 8*,1180283. https://doi.org/10.3389/feduc.2023.1180283

Lee, H., & Bryan, L. M. (2025). Integrating AI in teacher education: exploring the impact on preservice teacher competencies. *Professional Development in Education, 51*(3), 478–494. https://doi.org/10.1080/19415257.2025.2490000

Manrique-Losada, B., Zapata Cárdenas, M. I., & Arango Vásquez, S. I. (2020). Entorno virtual para cocrear recursos educativos digitales en la educación superior. *Campus Virtuales, 9*(1), 101–112. http://www.uajournals.com/ojs/index.php/campusvirtuales/article/view/632

Okuonghae, O. (2025). Advancing information literacy through immersive technologies in the metaverse age: A rapid review. *Digital Library Perspectives*. https://doi.org/10.1108/DLP-01-2025-0005

Públio Júnior, C. (2018). O docente e o uso das tecnologias no processo de ensinar e aprender. *Revista Ibero-Americana de Estudos em Educação, 13*(3), 1092–1105. https://doi.org/10.21723/riaee.v13.n3.2018.11190

Rojas López, A. J., & De La Caridad Ávila Aguilera, Y. (2019). El uso de las TIC como recurso para la autosuperación del profesional de la educación. *Dilemas Contemporáneos: Educación, Política y Valores, 6*(3), 53. https://dilemascontemporaneoseducacionpoliticayvalores.com/index.php/dilemas/article/view/1828

Torres-Flórez, D., & Diaz-Betancour, D. M. (2021). El panorama de los profesores universitarios en Colombia respecto a sus competencias digitales. *Clío América, 15*(29), 666–675. https://doi.org/10.21676/23897848.4375