Higher education's role in developing primary school teachers' IT competence: Information and educational environment

El papel de la educación superior en el desarrollo de las competencias en ti de los docentes de escuela primaria: Información y entorno educativo

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Abstract

The study aims to explore the competency-based approach and the integration of information and digital competence in the New Ukrainian School concept. The study employed a research framework that involved an analysis of the current state of education in Ukraine, including an examination of teacher education, professional development programs, and competency-based approaches. The study confirmed the hypothesis that enhancing teacher effectiveness is achievable through continuous improvement and adaptation of the information and educational environment. The findings revealed the need to update education content to meet the requirements of the modern information society. The integration of

information and digital competence was found to be crucial, considering the growing use of technology in education. The New Ukrainian School concept emerged as a significant approach to address these challenges and foster teacher competence in the digital era. The study concludes that prioritizing the improvement of teacher education, professional development, and competence is essential for Ukraine to realize its goal of joining the European educational environment. The competency-based approach, along with the integration of information and digital competence, offers a promising framework for updating education content. By continuously enhancing the information and educational environment, Ukraine can nurture a skilled and adaptable teaching workforce capable of meeting the demands of the modern era.

Keywords: competence, informational sphere development, learning, technology, HEIs.

Resumen

El estudio tiene como objetivo explorar el enfoque basado en competencias y la integración de la información y la competencia digital en el concepto de la Nueva Escuela Ucraniana. El estudio empleó un marco de investigación que involucró un análisis del estado actual de la educación en Ucrania, incluido un examen de la formación docente, los programas de desarrollo profesional y los enfoques basados en competencias. El estudio confirmó la hipótesis de que es posible mejorar la eficacia de los docentes mediante la mejora continua y la adaptación del entorno informativo y educativo. Los hallazgos revelaron la necesidad de actualizar los contenidos educativos para cumplir con los requisitos de la sociedad de la información moderna. Se encontró que la integración de la información y la competencia digital es crucial, considerando el creciente uso de la tecnología en la educación. El concepto de la Nueva Escuela Ucraniana surgió como un enfoque significativo para abordar estos desafíos y fomentar la competencia docente en la era digital. El estudio concluye que priorizar la mejora de la formación docente, el desarrollo profesional y la competencia es esencial para que Ucrania logre su objetivo de unirse al entorno educativo europeo. El enfoque basado en competencias, junto con la integración de la información y la competencia digital, ofrece un marco prometedor para actualizar los contenidos educativos. Al mejorar continuamente la información y el entorno educativo, Ucrania puede nutrir una fuerza laboral docente capacitada y adaptable capaz de satisfacer las demandas de la era moderna.

Palabras clave: competencia, desarrollo de la esfera informacional, aprendizaje, tecnología, IES.

1. Introduction

The Law on Education of Ukraine -2017- obliges adaptation to the modern European educational environment and makes the development of citizens' skills a central task. As stated in the Concept of the New Ukrainian School, a practical approach requires reviewing and updating the model and format of teacher education. Learning must take place in a modern educational and information environment.

The concept of the information environment was first proposed by Schrader Yu. A. (1976), who believed that the informational environment is not only an information mediator but also has a positive impact on its participants. According to Geiger, S. M., Fischer, D., Schrader, U., & Grossman, P. (2020), the authors proposed a semantic approach to the cognition phenomenon and a mechanism for determining the degree of semantic knowledge (as a measure of change in its vocabulary under the impact of the information received) and the accumulation of knowledge and possible skills, the concept of society, and the available knowledge about the information environment. This study provides a mathematical analysis of data transmission, processing, storage, research, and information carriers in terms of knowledge acquisition and information perception. It is determined that knowledge and information potential are also a combination of intellectual capabilities (the collective ability of people to solve problems arising from the accumulated knowledge, skills, and experience) and information potential (the ability to collect, store, research, and transmit information to ensure the achievements of society members) and the level of awareness necessary

for their tasks. At the same time, the study is aimed at the perception of information at the level of public opinion and is not adapted for students and school children.

Ramadhan, S., Sukma, E., & Indriyani, V. (2019) also studied the information and learning environment. Based on a survey of educational process participants, they identified areas for the formation of environmental awareness. At the same time, the survey was conducted on teachers who taught language disciplines and did not consider the peculiarities of teaching in primary school. Similar studies were also conducted by Abdel-Basset, M., Manogaran, G., Mohamed, M., & Rushdy, E. (2019) and Romero, C., & Ventura, S. (2020). According to their functional purpose, the authors determined that information and learning environments are divided into three types: information-oriented presentation, independent work, and a mixed environment focused on obtaining information. At the same time, an information and learning environment organizes various independent cognitive activities. As a rule, these environments are created within the framework of publicly available technologies or based on professionally developed shells focused on distributed collaboration and other environments based on communication technologies. They are open to teachers and students, allowing them to add and edit content and display the results of ongoing learning activities.

Liu, Z. J., Tretyakova, N., Fedorov, V., & Kharakhordina, M. (2020) have identified that the methodological basis for creating models of modern educational institutions' information and educational environment is the use of the "human-environment" system as a primary research unit. Asad, M. M., Hussain, N., Wadho, M., Khand, Z. H., & Churi, P. P. (2021) propose to start forming an information and educational environment for educational institutions by improving the mechanisms for using the information and educational system of teachers and improving the skills of information computer technology with the further involvement of students and schoolchildren in the process. Thus, the mandatory organizational stages of creating an information and educational environment of an educational institution are as follows:

– Passing exams.
– Approving training structures.
– Surveying teachers and students.
– Creating educational platforms (websites) and organizing self-education improvement.

Such an information and pedagogical communication process constitutes the curriculum's pedagogical, methodological, and organizational foundations and is a core element of the educational process. However, under current circumstances, there is a need to adapt this process to the requirements of the external environment to create and implement new products and mechanisms into the learning environment.

According to Hevner, A., Vom Brocke, J., & Maedche, A. (2019), and Urbach, N., Ahlemann, F., Böhmann, T., Drews, P., Brenner, W., Schaudel, F., & Schütte, R. (2019), to solve the problem of creating an educational information space, this issue can be solved by purchasing various software products that combine the functions of an information system and thus solve multiple tasks, such as:

– storage of personal digital records (databases) of students and employees of educational institutions;
– ensure communication with all participants of the educational process (including via the school's website);
– access to a wide range of digital educational sources;
– accessibility and transparency of educational process results for all participants (timetables, lists of students, teachers, lessons, results, and information on attendance);
– monitoring the quality of education (analysis and reporting on learning outcomes);
– automation of learning management processes (planning, workload assignment, and curriculum planning);
– availability and support of electronic document management;

- using a software environment that creates the school's information space;
- providing organized, secure, high-quality information (preventing students from receiving inaccurate information).

Primary school teachers' knowledge of individual student needs is essential to the information and educational environment. Various structural changes in people suggested by Fomin, I., Kokarev, K., Ananyev, B., Neklyudov, N., Bondik, A., Glushkov, P., ... & Wohlforth, W. (2021) provide an illustrative framework for studying individual qualities and communicators' characteristics. At the individual level, teachers should consider the flexibility of the student's neural system and its personality traits, such as activity and emotionality, which are prerequisites for communication skills. At the professional level, it is necessary to distinguish students' previous communication experience from the aspects of knowledge of communication activity models, communication skills, and perseverance in paired communication behavior (Onishchuk, I., Ikonnikova, M., Antonenko, T., Kharchenko, I., Shestakova, S., Kuzmenko, N., & Maksymchuk, B., 2020). At the individual level, experts recommend taking into account a person's care for themselves and others, as well as social roles, strong value orientations, tendencies, and moral qualities (Bekmurodov, M., Akhmedova, F., & Kadirova, K., 2020). While considering the personal approach, it is necessary to focus on how self-regulation mechanisms are developed regarding self-esteem and the ability to take a reflective position towards self-reliance. Knowledge of students' individual characteristics allows the teacher to study and observe students' individual and personal ones. After all, psychological and instrumental communication mechanisms and presentation skills should be different for each group of students. Today, the age limit of primary school, corresponding to the primary grades, is set between 6-7 and 9-10 years (Tsarava, K., Moeller, K., Román-González, M., Golle, J., Leifheit, L., Butz, M. V., & Ninaus, M., 2022). Children of primary school age are easily distracted, unable to concentrate for a long time, and are nervous and emotional. When entering primary school, there are significant changes in the child's intellectual development: a qualitative change in the cognitive environment, personality formation, and relationships with peers and adults. During this period, the ability to willfully regulate behavior undergoes qualitative changes. In primary school, a child begins to form a new type of relationship with others. The absolute authority of adults gradually disappears, schoolmates become more important to children, and their role in society increases. The following fundamental achievements of primary school include:

- a qualitatively new stage in regulating freewill behavior and actions;
- self-reflection, analysis, and planning of internal work;
- creation of a new approach to an understanding of reality;
- a focus on schoolmates' peer groups.

The significant changes in the psychological image of primary schoolchildren prove the possibility of comprehensive development of these children. The child's potential to become an active participant is realized. The children learn to understand the world around them, gain experience of their actions in this world, and control their behavior. The ability to recognize the teacher is a necessary part of their communication because attention to students and classmates is the main learning method.

This article aims to analyze the structure and components of creating an information and educational environment based on the formation of primary school teachers' competence to ensure optimal professional training in the framework of multi-level education.
The authors have set and fulfilled the following tasks to achieve this goal:

- to analyze the historical experience of forming the information and educational environment;
- to study the impact of information and educational environment quality on the formation of primary school teacher's competence;

– to form a mechanism for improving the information and educational environment to ensure the formation of primary school teachers' competencies.

The object of this research is the principles and methods of forming the information and educational environment.

The research subject is the relations between the educational process participants within the formation of the information and educational environment.

2. Methods and materials

In this study, the researchers employed a descriptive research method to investigate the development of the information-educational environment and its role in enhancing the professional and communicative skills of future primary school teachers. The descriptive analysis aimed to delve into the historical context and explore unobservable data or patterns for analysis and reporting.

To gather relevant information, there was utilized several techniques and procedures. These may have included:

Literature Review: A comprehensive review of existing literature on the development of the information-educational environment, professional and communicative skills of primary school teachers, and relevant educational programs and standards. This helped establish a theoretical framework and identify key research gaps.

Document Analysis: Examination and analysis of official documents, such as the National Program for the Development of Education in Ukraine in the XXI century (2001) and the "Basic Standards of National Education" (2011). This allowed to identify the specific requirements and guidelines pertaining to the development of professional and communicative skills in primary school teachers.

Data Analysis: Analyzing the collected data using appropriate analytical techniques, such as thematic analysis, content analysis, or statistical analysis. This allowed for the identification of patterns, trends, and key findings relevant to the research objectives.

By employing these techniques and procedures, there was aimed to provide a comprehensive understanding of the historical development of the information-educational environment and its impact on the formation of professional and communicative skills in primary school teachers.

3. Results

Primary school teachers' information and educational environment is a dynamic process of forming knowledge, skills, and professional and pedagogical excellence. At the same time, the information environment for the educational process has gone through a long period of development (Figure 1). At each stage, the principles and methods of obtaining information have undergone structural changes and transformations.
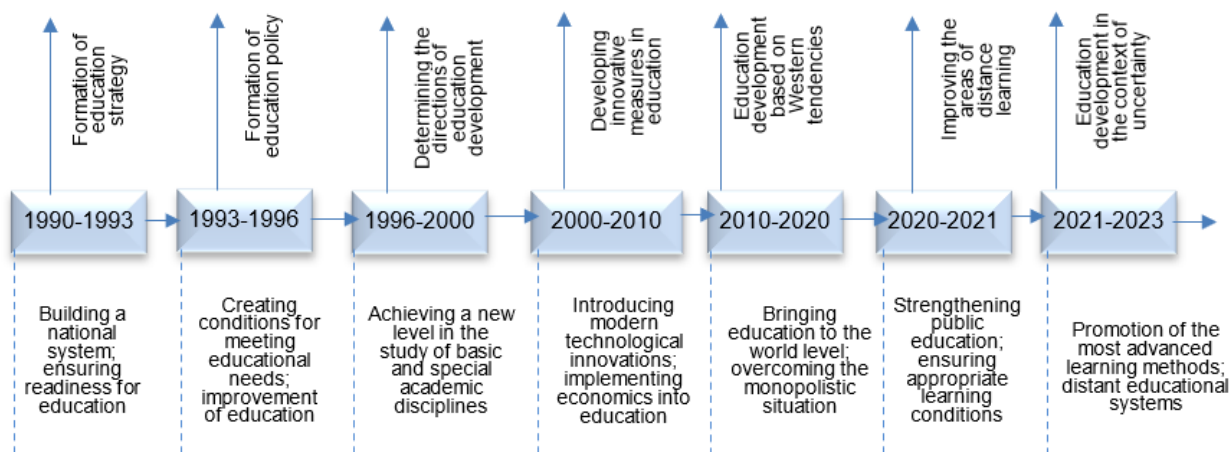
Figure 1. Stages of forming an information environment in educational activities.
Source: built by the authors.

Nowadays, the academic world's challenge is organizing school education according to the individual's professional and communicative development. Communicative creativity ensures that mastering the activities defined by the teacher's profession is crucial in developing a professional interpersonal communication and communication culture. According to modern scientific opinions, Semerikov, Striuk, Striuk, Striuk, & Shalatska (2020), Kirca, & Bademli (2019), Swartz, Barbosa & Crawford (2020), communicative competence is a complex personality trait, understood as the ability of communicators to apply their knowledge, skills and experience in professional fields. Therefore, it requires identifying primary school teacher competence's essence and structural elements. The structural elements of primary school teacher competence include:

– linguistic culture (better mastery of language norms, appropriate choice of verbal and non-verbal means);
– pedagogical delicacy (the ability to select and apply pedagogical knowledge in practical teaching);
– knowledge of norms and rules of communication (communication laws, moral requirements, ethical and moral standards, customs, cultural traditions);
– information about students' individual characteristics and their independent educational and learning abilities.

At the same time, language competence is particularly important for elementary school teachers as it is one of the most important factors that influence children's psychological and emotional functioning. It is connected to the fact that adult parents and teachers are authoritative among primary school pupils. Therefore, primary school pupils simply imitate the words and actions of the teacher, so the teachers have to work hard to show a good example. In elementary school, the minimal basis of language and culture is formed: in the junior and senior classes, spelling, style, grammatical norms, and speech etiquette are formed and developed, so they are basic knowledge on which the success or failure of the secondary school depends. The language culture of future elementary school teachers as a socio-pedagogical phenomenon is formed by improving the internal direction of individual speech styles, striving for professionalism and cultural self-determination, and the ability to use linguistic tools (vocabulary, phonetics, grammar). Subject-subject relationships of the participants in the educational process are realized through the implementation of various means and styles, emphasizing the humanistic orientation of communication, the status of teachers, the application of interactive teaching methods, focusing on problems, cognitive research, emotions, behavior, and culture, ensuring dialogue and interaction between participants in the educational

process, designing students' research experience, purposeful implementation of students' experience exchange, and the completion of professional practice by future elementary school teachers.

For this purpose, information resources from educational institutions are used, which can be conditionally divided into five blocks:

– educational and upbringing activities,
– informational and methodological activities,
– scientific and practical activities,
– administrative and economic activities,
– cultural and educational activities.

In Table 1, the authors compare the proposed information resources and their impact on forming primary school teachers' competencies. The considered components of the information space form a common information and educational environment for primary school teachers and ensure the acquisition, improvement, and development of the necessary competencies in professional activity. The systematic and complex nature of the information and educational environment requires creating a unified information space that would consider the dynamism and uncertainty of the external environment and the prospects for implementing innovative technologies. The creation of a unified information space and a database of educational institutions should start with specific work and depends on the educational institution's material and technical base and capabilities.

Table 1.
Comparative characteristics of information resources for implementing the educational process in primary school

Information resource	Content	Application areas	Impact on competencies formation
Educational and upbringing activities	The work of the academic community of the educational institution, which is responsible for the development of professional skills necessary for life and career in an informational society	This work should include the provision of digital libraries, the creation of media libraries, publishing, and web activities	Formation of knowledge about professional activities and skills in applying the acquired knowledge in practical activities
Informational and methodological activities	Includes a set of procedure techniques for various forms of training (project-based, individual, distance, etc.), i.e., creation of electronic textbooks, software programs, and organization of online meetings and consultations	Educational activities, methodological support of the educational process, independent work of educational process participants	The ability to use information resources in professional and practical activities and the formation of information culture skills
Scientific and practical activities	It contains information about electronic learning content for basic, additional, and specialized high school courses	Conferences, symposiums, forums, practice-oriented learning	Acquiring new knowledge, developing practical skills for use in professional activities
Administrative and economic activities	It includes various documents: textbooks, planning of educational processes, class records, information on the health status of school children and staff, and creation and depiction of psychological and pedagogical diagnostics of students	Creation of online libraries, educational platforms, informational websites and services, e-journals, and educational sources	Use of acquired knowledge and skills for creating an information environment and applying the developed organizational skills
Cultural and educational activities	It is responsible for shaping the culture of pupils, including virtual museums, historical sites, art galleries, and music compositions. This component ensures culture, creative activity, high morality, and tolerance	Museum visits, professional exhibitions, theater plays, educational trips, historical sites, workshops, and handmade crafts	Acquiring new knowledge in additional professional activities, expanding the range of skills and abilities in creative activities, and demonstrating handmade skills

Source: built by the authors.

The data space model may contain several levels. At the first level, the acquisition of basic competencies is ensured based on the formation of knowledge and skills necessary for the professional activity of the teacher. The second level of the system is professional competencies, which include personal qualities, general culture, qualifications, abilities, methodological skills, and their harmonious combination with pedagogical activity to ensure optimal results. At the third level, the formation of pedagogical competencies is carried out based on ensuring the self-development of the teacher and improving the skills and abilities of professional mastery. The mechanism for forming the information and educational environment of primary school teachers is presented in Figure 2.
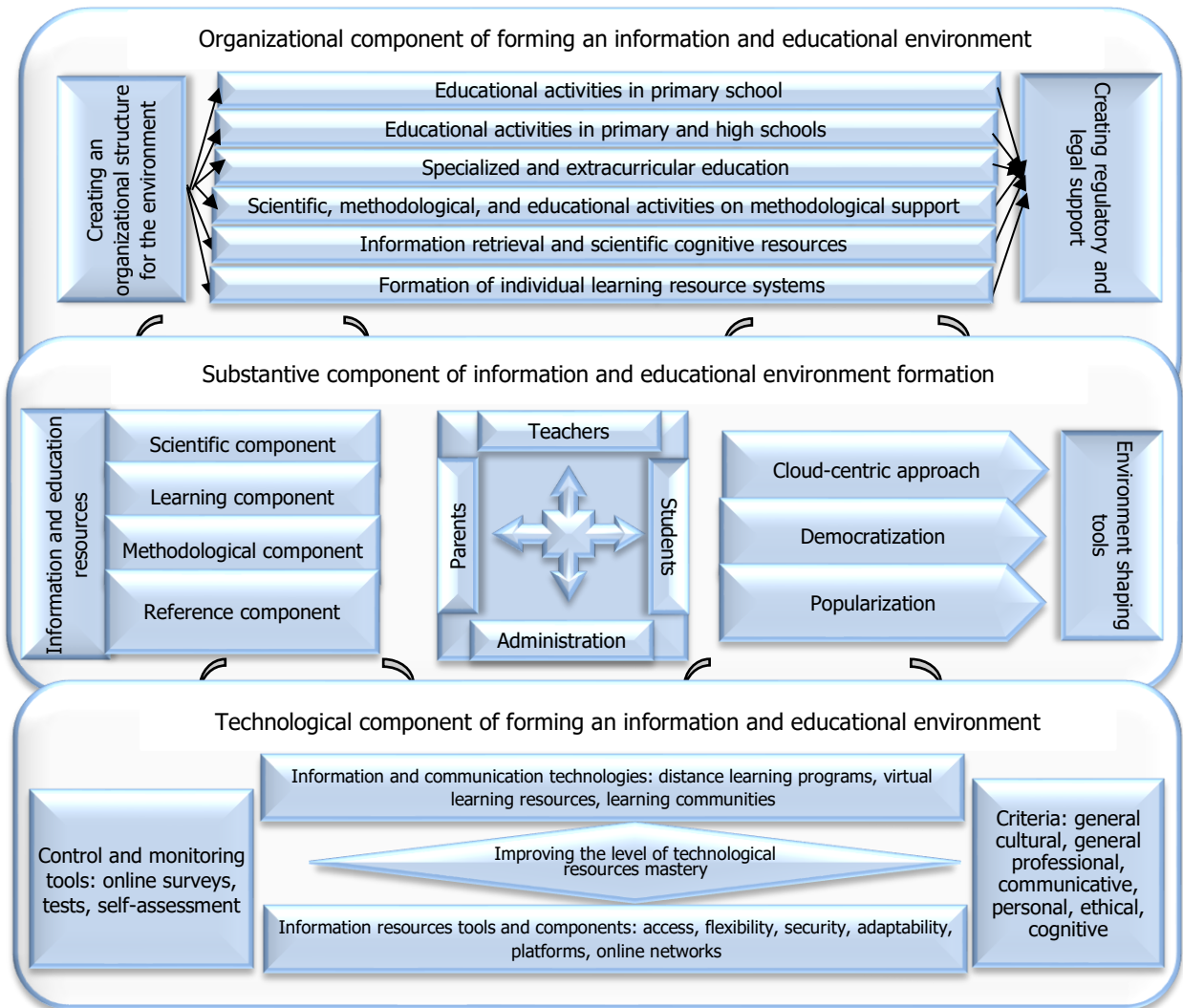

Figure 2. The mechanism for forming an information and educational environment for the development of primary school teachers' competencies (elaborated by authors)
Source: built by the authors.

Everyone who participates in the educational process is responsible for the functioning of all aspects of the information and educational environment. Subject teachers create personal portfolios, and organizational and methodological leaders fill the teaching portfolios of teachers and provide methodological support for the educational process. The library is stocked with electronic textbooks, and the school media library is monitored for effectiveness (in which librarians, students, and teachers participate). Departmental deputy

directors are responsible for completing and providing materials for professional education and training. The office manager creates and maintains a database of employees and students. Through monitoring in this direction, operational management decisions can be made to improve the quality of education and professional training. The collection and analysis of large volumes of source data and reference documents create the necessary basis for developing and improving the information and educational space.

Thus, the information and educational environment is a system in which all subjects of the educational process participate and communicate with each other at the information level: administration – teachers – students – parents:

- when planning the information and educational environment, the content of the modern stage of education should be taken into account, as well as the correlation of traditional components of the educational process with new information and communication technologies, new relationships between students and teachers, and the educational environment;
- the sphere of information literacy includes technical, informational, and organizational resources;
- in creating a knowledge-based educational environment in educational institutions, in the conditions of intensive use of information and communication technologies, the importance of teachers' competence in the school educational process has increased.

4. Discussion

During the research process of creating and adapting an information and education environment, it was determined that the implementation of information technologies and the preparation of the pedagogical team for the use of information system tools are the most essential components for its successful implementation into the educational process. At the same time, the process of preparing teachers and implementing computer technologies in educational institutions should go in parallel. Cahapay, M. B., & Anoba, J. L. D. (2020) identified that the success of implementing and effectively organizing an information and education environment partially depends on teachers' readiness for innovation, which was thoroughly assessed during the COVID-19 crisis when teachers' readiness for transition to blended learning was evaluated. Similar studies on forming an information and education environment in conditions of uncertainty were conducted by Bagbekova, L. (2020), Schmidt, J. T., & Tang, M. (2020). A network administrator who will manage the process is needed to use information technologies in the educational process. These administrators create information and education systems for educational institutions and recommend, initiate, and implement telecommunication projects. Another task is to teach subject teachers how to use computer technology tools. Research and work experience have shown the advantages of using an information and education environment in educational institutions (Castro, M. D. B., & Tumibay, G. M., 2021, Sadeghi, M., 2019). Thus, the presence of an effective information and education environment forms and guarantees quick and reliable access to available information, the ability to communicate in real-time, electronic data storage, including remote storage, the ability to store practically unlimited amounts of educational data, work automation, and interactive learning environment.

Within the framework of forming a competency-based approach, the professional training of future elementary school teachers should be based on the following principles:

1. The principle of human orientation, creating conditions for the development of students' best qualities and abilities; humanization of relations between teachers and students, respecting the personality of the future specialist, understanding their requirements, interests, and personal dignity.
2. The principle of democratization involves the elimination of authoritarian methods of communication. To consider the future teacher's personality as the highest social value, to determine their right to freedom, and to develop their pedagogical abilities.

3. The qualification principle should create conditions for developing the necessary structural elements of complete pedagogical competence.
4. The principle of teaching creativity involves creating conditions for developing the individual's creativity.
5. The problem-solving principle concerns the orientation of future specialists toward solving practical educational tasks.
6. The principle of realism concerns the orientation of graduates of general education schools towards the real educational goal, mastering the means and methods necessary to achieve this goal.
7. The principle of teaching self-development involves leading students toward self-development and self-realization by creating conditions that constantly satisfy their spiritual and educational needs. Professional training of future teachers is effective only when implemented in a complex of the above principles and principles and is comprehensive.
8. The principle of individual orientation – choosing methods, forms, and content of education according to students' natural learning inclinations, conscious response to their spiritual needs and interests, and promoting spiritual self-realization.
9. Introducing new educational technology, the principle of technological unification in the educational process.
10. The principles of dialogue in education – rejecting monologues as socially oriented communication; developing students' skills to see the interlocutor's strengths and weaknesses and think critically.

Professional training of future primary school teachers aims to ensure their competitiveness in the market of educational services. These are the main tasks of forming the professional ability of future primary education specialists:

– creating conditions for the formation of the professional culture of future specialists.
– intensifying the formation of basic skills for future primary school teachers.
– ensuring self-organization and procurement of competitive technologies.
– preparing student career mobility.
– organizing methodological and educational support for pupils.
– forming social activity considering personal characteristics and social abilities.

Thus, the professional qualification of a primary school teacher is a system of related areas (motivational and value-oriented, content, operational-personal, and reflective activities).

5. Conclusions

A high-quality information environment must be ensured to solve one of the main tasks of a modern general education institution - to prepare graduates for life in the information society. The information and educational environment can be called efficient if:

– there is an organizational structure for collecting and storing information resources and providing information services;
– a system for assessing the quality of the information and educational environment has been developed and operates as an integral part of the quality management process;
– the information environment combines regional, national, and global resources to ensure the progress of education and improve the quality of teachers;
– the education of teachers and students is adapted to the current state of information technology development, and computer skills courses are offered to improve teachers' computer skills;
– information resources are diverse and suitable for different user groups;
– new information technologies (electronic catalogs, Internet connection, virtual services) are used to support the information environment;
– local networks and workstations have up-to-date licensed software.

An important factor in the quality of information support is the information infrastructure of educational institutions, which includes the availability and quality of external communication channels for accessing resources and local networks, the quality of information and content organized on internal network servers and the internet, the quality of management information in educational process software products, the availability of organizational structures for the use of information resources, and technical support.

However, there needs to be more clarity in providing information, which lies in the quality of its management. The lack of an effective information management system leads to ineffective management decisions, data duplication, and loss. Creating a data management system in educational institutions optimizes existing data collection channels and meets the information needs of administration, teachers, students, and parents.

In this article, the authors propose a mechanism for improving the information-educational environment, which includes three levels, to address this problem.

At the first level, the organizational component of the information-educational environment is formed. The organizational structure is formed at this level, and the regulatory framework for providing and perceiving information is developed.

The second level is the substantive component of the information-educational environment, which includes a mechanism for transforming information resources into tools for implementing the information support of the educational process. Again, all interested parties in the educational process, such as teachers, administration, students, and parents, should be involved in this process.

The technological component of forming the information-educational environment is ensured at the third level. At this level, methods and techniques are developed to ensure the formation of an effective information-educational environment, such as software, online services, and internet resources.

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