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DOI: https://doi.org/10.34069/AI/2024.76.04.16

How to Cite:
Hrechanyk, N., Eganov, A., Bandura, V., Aramyan, A., & Shijia, H. (2024). Digital educational environments: strategies and tools for training competent professionals. *Amazonia Investiga*, *13*(76), 202-216. https://doi.org/10.34069/AI/2024.76.04.16

Digital educational environments: strategies and tools for training competent professionals

Цифрові освітні середовища: стратегії та інструменти підготовки компетентних фахівців

Received: February 28, 2024 Accepted: April 28, 2024

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Abstract

The article highlights digital educational environments, describes strategies and tools for training competent specialists. Ways of using digital technologies in education and their didactic possibilities are revealed, key characteristics are listed. The purpose and tasks of the digital educational environment of educational institutions of modern society are specified. The process of building a digital educational environment of an educational institution is shown. The most important software of the information system of professional training, which should be in the information and digital educational environment of the educational institution, is highlighted. The necessary conditions and organizational principles of creating an effective digital educational environment of an educational institution are substantiated. The main goals and recommended tasks regarding the formation of a digital

Анотація

У статті висвітлюються цифрові освітні середовища, описуються стратегії та інструменти підготовки компетентних фахівців. Розкрито шляхи використання в освіті цифрових технологій та їх дидактичні можливості, виписано ключові характеристики. Зазначено мету та завдання цифрового освітнього середовища закладів освіти сучасного суспільства. Показано процес побудови цифрового освітнього середовища закладу освіти. Виділено найголовніше програмне забезпечення інформаційної системи професійної підготовки, що має бути в інформаційно-цифровому освітньому середовищі закладу освіти. Обгрунтовано необхідні умови та організаційні принципи створення ефективного цифрового освітнього середовища закладу освіти. Запропоновано основні цілі та рекомендовані завдання, щодо формування цифрового освітнього середовища

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educational environment in an educational institution are proposed. An experimental study was conducted to find out the level of digital competence of future specialists and the role of the digital educational environment in the educational institution.

Keywords: information and digital educational environment, educational institutions, digital competence, digital resources, information technologies.

у закладі освіти. Проведено експериментальне дослідження з метою з'ясування рівня цифрової компетентності майбутніх фахівців та роль в цьому цифрового освітнього середовища у закладі освіти.

Ключові слова: інформаційно-цифрове освітнє середовище, заклади освіти, цифрова компетентність, цифрові ресурси, інформаційні технології.

Introduction

Digital technologies serve as a potential for stimulating more inclusive and sustainable development and stimulating innovation, contribute to increasing the efficiency of educational services. Today, it is important to take advantage of the digital transformation, which contributes to the creation of jobs and provides access to educational services, as well as allows solving potential problems (Ovcharuk et al., 2022).

Today's realities require not only a high level of education of specialists, but also a new type of intelligence, way of thinking, speed in communication and professional mobility and digital competence. This will ultimately change their attitude to the rapidly changing economic, technological, social and informational factors of production and the surrounding world.

Conceptual changes in the system of professional education are prompted by the wide spread of new digital technologies, in particular: distance learning, personalization of data, virtual classes, cloud and Internet technologies, autonomous learning and information consulting. Successful modernization of educational systems with the use of digital technologies is possible under the conditions of the implementation of many projects, one of which is the creation of a unified information environment of the educational institution, which will provide effective support in the professional formation of specialists (Shynkariova, 2022).

The introduction of digital technologies into the educational process and its digitization allows the implementation of a new format of education.

In the modern educational situation, there are a number of contradictions between:

– the need to introduce innovations caused by the processes of digitization and European integration, a significant amount of accumulated domestic and foreign experience in the organization of the institution's information environment, and the degree of theoretical substantiation of the scientific and methodological foundations of its introduction into the practice of the educational institution;
– requirements for the level of digital literacy of teachers and students and the degree of formation of the level of readiness of subjects of the educational process in the information environment of the educational institution;
– the leading importance of information activity in the provision of quality educational services and the insufficient development of theoretical and methodological support for its organization within the digital environment of the educational institution (Tkachuk, 2015).

Considering the issue of digital technologies, in the article we considered the main aspects of the problem of digitalization in the training of specialists, namely: ways of using information technologies in education and their didactic possibilities and key characteristics; the tasks of the information and digital educational environment of educational institutions of modern society; the process of building an information and digital educational environment of an educational institution; necessary conditions and organizational principles for creating an effective information and digital educational environment of an educational institution; the main goals and recommended tasks regarding the formation of the information and digital educational environment in the educational institution; experimental investigation of the level of digital competence of future specialists and the role of the information and digital educational environment in the educational institution.

Literature Review

The system of designing the info and digital educational environment of the establishment of higher education in modern society was considered by M. Topuzov (2018), the conceptual approaches to the educational institution, the construction of its SMART model, the content and its structure of the institution, the advantages of the introduction of information management systems, software, information technologies are shown. free social tools for education (Tools for Learning).

The same problem is investigated by O. Ovcharuk, O. Hrytsenchuk, I. Ivaniuk, L. Kartashova, O. Kravchyna, M. Leshchenko, and I. Malytska (2022). Scientists have analyzed the theoretical and organizational modern methods to the development and construction of the information and digital educational environment of the educational institution. The components of such an educational atmosphere are characterized by the conditions of global education reform; a model of the information and digital educational environment of general secondary education institutions was developed, organizational and pedagogical conditions were identified.

Y. Zavalevskyi, N. Gushchyna, I. Vasylashko, O. Korshunova, and O. Patrykeieva (2022) determined the conditions for the implementation of the research method of teaching using STEM technologies and information technologies in institutions of general secondary education: on the basis of the research method of teaching, the creation of modern educational content and STEM approaches, improvement of the content of educational support; creation, for the training of teachers, of scientific and methodological support and acquisition of practical experience based on STEM and IT approaches for the growth of research capability of education seekers; participation of school teams in various motivational activities of the research direction and STEM.

V. Bykov, D. Mikulowski, O. Moravcik, S. Svetsky, and M. Shyshkina, (2020) examine and justify the importance of a computer-oriented educational environment and divide it into closed and open, the first of which at this stage prevailed in educational institutions and received significant development in universities.

N. Vodopian (2023) proposed means of creating a cloud-oriented educational environment. The educational programs developed by him for the subjects of the technological and natural-mathematical cycle of secondary schools have an experimental component, which students implement through practical and laboratory work. The scientist proved that in the didactic process of natural sciences, the use of an educational independent experiment is a psychologically and pedagogically confirmed and substantiated educational practice.

The same problem is also investigated by S. Lytvynova (2015), who developed the theoretical and methodological foundations of designing a cloud-oriented educational environment in a general educational institution, outlined the features of the communication-organizational component of a cloud-oriented educational environment, and revealed the functioning of the spatial-semantic component, defined the component model of the general educational educational institution, in particular, a cloud-oriented educational environment.

M. Sherman, Ya. Samchynska, Yu. Korniienko (2021) grouped the development of the information system and the main stages of professional training of higher education students and distinguished the ways of designing, described the process of the web system interface, architectural design, developed prototypes of the main pages of the system, developed a scheme of the website; provided the structure of the database and provided its description, substantiated the technologies used in the process of developing the information system of professional training. PHP was chosen as the programming language, WordPress CMS was used for development. The information system for professional training of students presented by the authors, a feature of which for those seeking higher education is the development of a parser for automated filling of the database of educational resources, thereby reducing the need for manual filling of the information system by users, which allows improving the process of updating materials for students.

In order to improve the quality of training of future teachers of preschool education institutions, V. Shynkariova (2022) made an analysis in a higher education institution of the theoretical foundations of the formation of a digital educational space; in order to improve the quality of professional training of future teachers of preschool education institutions, she carried out a theoretical analysis of the conceptual foundations of the formation of a digital educational space, highlighted the impact of

information and communication technologies on the expansion of the content and opportunities of the educational space, developed tasks that improve the educational process and, through the introduction of innovative information systems, affect the quality training of future educators.

As a result of the analysis of scientific research from a specific direction, we note that in modern society, scientists are engaged in the systematic design of the information and digital educational environment of a higher education institution, developed conceptual approaches to an innovative educational institution, built its SMART models; determined the conditions for the implementation of the research method of education using STEM technologies and information technologies in institutions of general secondary education; justified the importance of a computer-oriented learning environment; developed means of creating a cloud-oriented educational environment; grouped the development of the information system and the main stages of professional training of higher education applicants; distinguished the ways of design, described the process of the web system interface, architecture design, developed prototypes of the main pages of the system and the scheme of the website.

The purpose of the article: to characterize the information and digital educational environment of the educational institution and show its necessity in the world space, to find out the level of digital competence of future specialists and the role of the information and digital educational environment in the educational institution.

The methodological basis of the research is the theory of scientific knowledge; complex of principles, approaches, provisions, unity of theory and practice; axiological, cultural, ethical, activity, system, personal approaches; holistic approach to the analysis of personality formation.

Methodology

The research is based on the use of a complex of the following methods: historical method for studying scientific and pedagogical literature; logical method – to identify objective regularities in the creation of a set of judgments and concepts in the formation of their content; method of induction and deduction – for gathering theoretical and factual material; the method of comparison and comparison – in order to determine the differences and similarities of the main research concepts; analysis and synthesis – for specification, methods and forms, meaningful content of the learned experience, as well as empirical: observation, survey of respondents – to find out the level of digital competence of future specialists and the role of the information and digital educational environment in the educational institution.

An experimental study was conducted to find out the level of digital competence of future specialists and the role of the information and digital educational environment in the educational institution.

During the experimental work, we developed questions for the determination of self-assessment by future experts – students of higher education, aimed at clarifying the level of their digital competence and the role of the information and digital educational environment in the educational institution. Questions were formed based on international approaches, in particular on the basis of the document "Digital Competence Framework for Citizens: Eight Levels of Mastery with Examples of Use" (DigComp 2.1: Digital Competence Framework for Citizens). The digital competence framework includes such levels: professional user, independent user, basic user. The Digital Competence Framework includes five areas of this competence: digital literacy and information, digital content creation, collaboration and communication, problem solving, and safety. The respondents' self-assessment was built on these levels and areas during this study. 179 respondents took part in the survey.

The purpose of the review was to reveal the defiance of those seeking education to the use of the information and digital educational environment of the educational institution, the ability of the respondents to create multimedia content in various formats, to reveal the opinion about the most effective digital tools, to increase the level of digital competence of future specialists, to develop the facility to explain difficulties when using digital technologies , which arise, etc.

The general changing aspects of increasing the level of digital competence of future specialists is not intensive enough, they do not actively create their own digital resources and use the information and digital educational environment of the educational institution, they do not use a wide enough range of ICT, they do not have the skills to protect personal information and devices, in most activities remain passive about the safe use of digital resources.

The respondents who answered the questions of the online survey noted that the attitude of the education seekers to the use of the information and digital educational environment of the educational institution, the ability of the respondents to create multimedia content in various formats, to express their opinion about the most effective digital tools, to increase the level of digital competence of future specialists, to form the ability to use digital technologies to solve problems that arise, etc. is not effective enough. Respondents attribute the following to the main problems: weak provision of high-speed Internet connection, inadequate access by educational institutions to digital devices and inadequate management of access to IT infrastructure.

Results and Discussion

The information and digital educational environment of an educational institution embodies in its concept "an ordered set of components for the development and self-development of spatially distributed subjects of pedagogical communication and information interaction mediated by means of information and communication technologies" (Familiarska, 2016).

Characterizing the information and digital educational environment of an educational institution, scientists consider it as "an open or closed ICT educational environment of pedagogical systems, the main didactic functions of which are the pedagogically expedient coordinated and integrated use of computer-oriented teaching aids, electronic educational resources and open or closed services information and communication networks focused on the needs of participants in the educational process". The information and digital educational environment of an educational institution is considered as "a systemically organized set of information, technical, educational and methodological support of educational institutions aimed at organizing the interaction of education seekers, teachers, school leaders and the public, as well as at the implementation of educational and educational influences that are supported digital means of data collection and transmission, hardware and software, and educational and methodological support. The information and digital environment of an educational institution is part of a single information space, which was formed as a result of a certain evolution of various resources, systems, structures, databases, subjects of interaction and other factors in a global context (Ovcharuk et al., 2022).

Solving the issue of designing a high-quality information and digital educational environment of an educational institution involves the complex formation of a unified information system in the educational institution, necessary through the creation of a communicative corporate infrastructure, a network of its divisions, which involves the use of computer and information technology, modern digital equipment, high-quality software tools with the integration of current information systems into the educational complex of technical solutions, design, software products involved in the environment, the creation of a management system for the development of education (Kharchenko & Shyshenko, 2021).

Therefore, the information and digital educational environment of an educational establishment is an innovative open scheme with means of information protection, where interconnected subjects of educational activity participate at the information level: students of education, scientific and pedagogical workers, administration, educational management bodies, pedagogical the public, etc.

Practically all participants of educational interaction create an information system with the corresponding information flows among themselves.

The updated political initiative of the European Union is the „Digital Education Action Plan (2021-2027)" (2020), presented by the European Commission (2020) which sets out a shared vision for accessible and high-quality digital education in Europe, aimed at supporting Member States' learning systems for the digital age and adaptation of education.

In the political guidelines of the EU (2019-2024), one of the priority directions is emphasized:

- compliance of Europe with the modern level of digital technologies;
- on the use of mass open online courses;
- on the role of education in the implementation of innovative plans, thanks to which the skills of people of any age and their capabilities are expanded;
- on modern approaches to learning using educational materials, online resources;
- on the development and mastery of digital literacy, digital skills of citizens of different age categories.

Research conducted recently by the European Commission (2020) showed that: do not have digital skills, do not own digital technologies – 43% of citizens of European countries. And today, 90% of jobs require basic digital skills (at least minimal).

Digital education of the world is becoming one of the key directions of the development strategies of all countries, one of the priority directions of the development of the education system.

In order to assess the state of digital education in European countries and analyze it, the Eurydice educational network conducted a study in 2019 entitled: Digital Education at School in Europe.

During the study, it was determined that, in accordance with the quick step of the spread of information technologies, digitalization of society (43 education systems participated in the study, of which 28 are member states of the European Union), digital education strategies were developed and are being implemented in almost all countries. Mainly in the countries of South-Eastern and Eastern Europe – digital education is included in larger-scale state strategies; mainly in Central, Western, Northern Europe – 18 education systems have their own digital education strategy (Ovcharuk et al., 2022).

Ways of using information technologies in education and their didactic possibilities and key characteristics.

Ways of using information technologies in education are:

- creation of information and digital educational environments of educational institutions;
- the use of IT in the management of an educational institution;
- creation of pedagogical software products;
- development of distance courses;
- creation of websites of educational institutions;
- creation of electronic libraries, media libraries, etc.

At the same time, it is worth highlighting didactic IT opportunities – positive and negative.

The positive ones include: consolidation of educational information; differentiation and individualization of education; ensuring the connection of practice, theory and management of cognitive activity; development and formation of the information culture of the individual; formation of the general culture of thinking and creative qualities of the acquirers of the educational space; creation of conditions for self-realization of the individual; ability to solve media education problems, etc. (López de Parra et al., 2017).

The negative ones include – the feeling of isolation on the part of the students of education; when studying imprecise disciplines, help is impossible, formal procedures and rules cannot be applied (religion, philosophy, sociology, etc.), etc. (Kademiia & Shahina, 2011).

Let us name the key characteristics of the information and digital educational environment of educational institutions of modern society:

- informational needs of a person;
- knowledge, knowledge economy,
- information space;
- information resources and networks;
- information products;
- information technologies;
- information processes, informatization process;
- IT support of various processes, etc.

In the process of designing objects of the information and digital educational environment of educational establishments of modern society, it is pedagogically appropriate and possible to use the following teaching tools:

- gamification of the scientific, educational, research process using methods that, taking into account the specifics of game thinking, are applied in the educational space, are characteristic of computer games in the non-game space. This approach makes it possible to receive measurable feedback, provides a step-by-step immersion of the learner in the learning process, dynamically adjusts the learner's behavior in the educational space;
- interactive and multimedia technologies for forecasting studied phenomena and processes, modeling and experiments;
- for the joint formation and use of collective knowledge of social media (blogs, social networks, tags, social multimedia, wiki-projects, bookmark services, social search systems, multiplayer network games, social geo-information systems, virtual worlds, etc.).

In the process of designing the information and digital educational environment of educational

institutions of modern society, it is important to foresee the creation on the foundation of current integrated solutions for the ground of education – information model, information architecture, management of information resources, concepts of information, m-Learning and m-Science approaches, effective information and organizational – economic mechanisms, principles of Social-Mobile-Access-Regulated-Technology, programs for the introduction of modern innovations and technologies, informatization of educational institutions (Ligarretto Feo, 2022).

The analysis of many years of experience and the best foreign practices in the field of education regarding the search for integrated solutions in it in the conditions of a developed information society makes it possible to form conceptual approaches to the construction of SMART educational institutions and environments for their functioning, a smart university – a SMART university based on the principles Social-Mobile-Access-Regulated-Technology (Topuzov, 2018).

The tasks of the information and digital educational environment of educational institutions of modern society.

The tasks of the information and digital educational environment of educational institutions in modern society are:

- support and provision of the organizational conditions of the educational process of the educational institution in modern society;
- providing access to distance learning resources and tools for education seekers;
- storage and accumulation of teaching-methodical and educational materials and content in free access for education seekers, psychologists, teachers, other pedagogical workers;
- promoting the creation of digital ability in subjects of the educational development;
- unification of educational activities and digital tools;
- support of communication and social interaction;
- providing access to web-oriented secure tools of the educational process;
- support for self-education activities of teachers and students;
- provision of learning conditions for those seeking education and a health-preserving environment for them;
- provision and support of feedback between applicants for educational space, teachers, institution administration;
- opportunities to build an individual educational trajectory;
- support for access to educational online resources, which is safe;
- support for monitoring the effectiveness of the implementation of the educational process and control of educational achievements of education seekers, etc.

The process of building an information and digital educational environment of an educational institution.

Let's consider the steps of the process of building an information and digital educational environment of an educational institution, which should provide that organizational and scientific-methodical support will help to achieve the set goal in accordance with the level of education, will ensure the educational process in the educational institution in accordance with the educational and educational needs of the students of the educational process and teachers, with the aim of providing high-quality educational services, means of distance learning, information and communication (digital) technologies and equal access of higher education seekers to digital information resources.

1. The social and communicative component of the informational and digital educational environment of the educational institution. The implementation of this very component in an educational institution is important for: establishing communication links and feedback between the administration of the institution, teachers and students of education, as well as for ensuring a safe and comfortable, health-preserving and confidential stay of students of education in this environment, which will attract them to participate in educational activities, motivate them to communicate and study, participate in the life of the institution where they study.
2. The technological component of the information and digital educational environment of the educational institution. This component includes in its content: cloud services, electronic educational resources, etc.
3. The organizational and operational component of the information and digital educational environment of the educational institution. this component is intended to ensure the organization of the activities of the subjects of the educational process in a digital format; is an important component of the environment; ensures a coordinated

educational process using ICT; contributes to the fulfillment of educational tasks.

Thus, in the information and digital educational environment of the educational institution, documents must be placed for the purpose of high-quality and timely planning of the educational process: educational and thematic plans, educational programs, electronic magazine, class schedules and other resources; basic information about the educational institution and information that ensures the openness and transparency of the institution's activities and its mode of operation are presented.

Of great importance in the information and digital educational environment of an educational institution are resources containing: methodical recommendations using ICT regarding the organization of methods and forms of education; features of control and monitoring of educational achievements of education seekers; sequence of tasks, work in inclusive groups, etc. (Manrique-Losada et al., 2020).

Also, educational simulators that can be used independently during remote classes, virtual classrooms, and virtual laboratories should be organized in the educational institution's information and digital educational environment. These tools support business educational games and facilitate extracurricular activities, classes, and practical tasks. The information and digital educational environment of the educational institution must provide access to informational messages and resources, such as video and audio recordings of lectures that contain ready-made student products in digital format (Ovcharuk et al., 2022).

Let's highlight the most important software of the information system of professional training, which should be in the educational institution's information and digital educational environment.

The following programming technologies were used to develop the information and digital educational environment of the educational institution:

- code editor Visual Studio Code;
- PHP;
- assembly of the local XAMPP web server;
- CMSWordPress.

To use the created information system of the information and digital educational environment of the educational institution, it is enough to have basic computer skills and it is not necessary to have special knowledge (Sherman et al., 2021).

One of the tasks of ensuring the effective functioning of the professional training information system, and its key directions, was the creation of a means of updating educational materials and automatic filling. Such a tool for an information system is a parser, a program that selects information according to a certain algorithm, performs syntactic analysis of websites, and saves the results for further display in a structured form. Special libraries and PHP programming languages (cURL and SimpleHTMLDOM) were used to develop the parser. The ArticlesScrap parser, which can be used on any website, was developed as a plugin for the WordPress content management system (Sherman et al., 2021).

The growth of an info scheme database is of great importance in the information and digital educational environment of an educational institution. CMSWordPress uses MySQL for its database management system.

The phpMyAdmin software is used for convenient database management, providing the student with access to the graphical web interface.

The WordPress system creates a database and structure on its own, which can be used immediately and, if necessary, expanded. Installed plugins also can create new tables, which are important for efficient work, and access to the database. The WordPress database that is created contains the following tables:

- the table in which metadata is stored for all comments that were not deleted on the site and were left – *wp_commentmeta*;
- the table used in earlier versions of WordPress to manage blogrolls or through the LinkManager plugin – *wp_links*;
- the table in which all comments and their data are stored, in particular, the record identifier, the identifier of the comment to which the comment was left – *wp_comments*;
- the table that stores most of the site's settings (URL address, date and time format, number of entries on the page, administrator's e-mail address, etc.) – *wp_options*. Some plugins also use this table to store their settings;
- the table that stores all kinds of custom types of records, pages – *wp_posts*;

- the table stores metadata about pages, records, and custom types of records – *wp_postmeta*;
- the table in which metadata (tags, categories, links) are stored for taxonomies – *wp_termmeta*;
- the table that stores associative relationships between tags, categories, and records – *wp_term_relationships*;
- the table that stores the data of users registered in the system (usernames, roles, biography, etc.) – *wp_usermeta*;
- the table that stores the relationship between categories and tags, the nesting of categories, and their description – *wp_term_taxonomy*;
- the table containing user data: password, registration date, login, e-mail –*wp_users*;
- the custom table in which information about the frequency of the parser launch is long-term stored – *wp_scrap_options*;
- the table with information about articles obtained by parsing, that is, a custom table. The data of such a table is used to prevent duplication of entries – *wp_articles*.

Almost all tables have relationships with other tables, which are implemented using special fields, and are within this database. However, the *wp_options* table is just one table that has no relationship with the others because it stores information about WordPress and site settings that are not related to users or records (Sherman et al., 2021).

Necessary conditions and organizational principles for creating an effective information and digital educational environment of an educational institution.

As evidenced by the research results, it is necessary to observe several conditions to create an effective information and digital educational environment of an educational institution:

- provide open access to the global Internet network, information channels of the internal local network, to media library resources;
- creation of opportunities for implementation of communication and information technologies in practice;
- to increase the quality level of the submission of new material – active use of digital technologies of the activity type and methods of project-research activity (Kidd, 2019).

Let's consider the generalized organizational principles of creating an effective information and digital educational environment of an educational institution to improve the quality of training future specialists (Shamraliuk, 2017):

- *uniformity* – the coordinated implementation in a technological, educational, unified logic of a variety of digital technologies that solve specialized problems in various spheres of the educational environment;
- *accessibility*, as a principle of unlimited functioning of non-commercial components of the digital educational space and commercial ones, through the use of the global Internet network, in compliance with license conditions, the requirements of education standards for each specific student of education;
- *openness* to interaction and replenishment of the complex of educational innovative technologies with actual digital ones;
- *competitiveness* – as a potential possibility of partial or complete replacement of the information and digital educational environment of the educational institution by competing systems, platforms, and technologies;
- *validity* – the principle of compliance with the capabilities and powers of the subject of the educational process, the composition of the information system to the goals, without the introduction of redundant data structures and the performance of redundant functions that require unjustified costs for their support;
- *responsibility* as a right, to participate in the coordination of tasks, the opportunity and obligation of each student of education to solve the tasks of informatization, and exchange of information with related information systems;
- *usefulness* – as a basis for reducing the labor costs of the user of the information and digital educational environment of the educational institution and, due to the implementation of the digital educational space, the formation of new opportunities.

The main goals and recommended tasks regarding the formation of the information and digital educational environment in the educational institution.

In the context of creating an effective information and digital educational environment of an educational institution, and improving the quality of professional training of future specialists, we analyze the main goals of forming

an information and digital educational environment in a higher education institution:

1) for education seekers:

- access to the most modern educational resources;
- expanding the possibilities of building an educational trajectory;
- erasure, on a global scale, of the boundaries of educational organizations;

2) for customers of educational services:

- increasing the transparency of the educational process;
- expansion of educational opportunities;
- formation of new conditions for motivating students when creating and completing tasks;
- facilitation of communication with all participants of the educational process;
- increasing the convenience of monitoring the educational process;
- implementation of control over students' success through automation;
- formation of new opportunities for the organization of the educational process;

3) for the provider of educational services, educational institution:

- due to the transfer of a part of the load to digital technologies – increasing the efficiency of resource use;
- due to automation – reducing the workload on personnel;
- at the expense of the network organization of the process – expanding the possibilities of the educational offer.

For effective functioning of the information and digital educational environment of the educational institution, we recommend performing several tasks (Morze, 2019):

- to develop new principles of data processing and regulations in the conditions of the transfer of document circulation to a digital format, taking into account the principle of moderation at all levels of process management and taking into account the requirements for the protection of personal information;
- revise the regulatory framework for the organization of the educational process and document flow to eliminate conflicts between modern electronic document flow and previous norms;
- approve as an industry standard and develop data exchange protocols;
- to develop the architecture of the information and digital educational environment in the educational institution, which allows for expansion of the composition and flexibly replaces the systems in its composition;
- compile a list of data that is constantly used in the field of education for exchange.

The formation of an information and digital educational environment in an educational institution allows educational institutions to provide a smooth solution to the problems of information transfer to the subjects of the educational process, storage, and retrieval. Educational institutions can now accumulate essential information resources in electronic form, the active digitization of which will have a positive effect on the quality of training of future specialists (Castro-Benavides et al., 2022).

Simplified access to the global Internet and the spread of personalized digital services bring new didactic and technical opportunities to the field of education. In particular, this is access to significant amounts of information, simplification of dialog communication, and the possibility of visualization, which allows the growing generation to form digital literacy in a complex (Shynkariova, 2022).

Experimental investigation of the level of digital competence of future specialists and the role of the information and digital educational environment in the educational institution.

During the experimental work, we developed questions for self-assessment by future specialists – students of higher education, aimed at clarifying the level of their digital competence and the role of the information and digital educational environment in the educational institution. Based on international approaches, questions were formed, in particular based on the document "Digital Competence Framework for Citizens: Eight Levels of Mastery with Examples of Use" (DigComp 2.1: Digital Competence Framework for Citizens) (Bykov et al., 2020). The digital competence framework includes such levels: professional user, independent user, and basic user. The Digital Competence Framework includes five areas of this competence: digital learning and information, digital content formation, collaboration and communication, problem-solving, and safety (Ovcharuk et al., 2022).

When determining the sample of subjects, the general specificity of the subject of the study was taken into account. The total sample size is 179 subjects. When forming the sample, the criteria of meaningfulness, representativeness, and equivalence were taken into account. The sample was formed by random selection using the technical procedure for calculating the selection step.

The reliability and validity of the obtained results, the objectivity of their assessment was ensured by the methodological soundness of the initial positions and the qualitative mechanism for evaluating the quality under study, the use of a complex of complementary research methods, and the involvement of a group of respondents from a higher educational institution in the analysis of its results.

To assess the homogeneity of experimental and control data, statistical processing was performed using MS Excel and SPSS (Statistical Package for Social Science).

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

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

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

The respondents' self-assessment was built on these levels and areas during this study. 179 respondents appropriated fragment in the study.

The following questions were asked.

1. "Do you experience problems while receiving information?" we heard the following responses:

– 20% of experiment participants search for information on the Internet using a search engine - basic user level;
– 41% of research participants emphasized that all of them can use different search engines to search for information - independent user level;
– 39% of students freely use advanced search strategies to find information on the Internet - professional user level.

2. "When searching for information, is it easy for you to assess its reliability?":

– 30% of research participants used information online and considered it not entirely reliable - basic student level;
– 25% of the participants of the experiment use filters when searching for information to check the reliability of the information found - the level of an independent respondent;
– 45% of survey participants freely assess the reliability of information using certain criteria - the level of a professional researcher.

3. "Are you able to communicate professionally using various means of communication?":

– 22% of experiment participants, using basic functions, can communicate with other users using Skype or chat basic student level;
– 35% of experiment participants, using advanced functions, can communicate with other users by using file sharing and Skype independent respondent level;
– 65% of survey participants use a wide range of communication tools for online communication professional user level.

4. "Are you able to create multimedia content in various formats in the information and digital educational environment of an educational institution?":

- 63% of students create simple digital content basic level;
- 31% of students use complex digital content in various formats - independent level;
- 6% of students in various formats can produce complex multimedia content using programming -professional level.

5. "Do you do programming?":

- 75% of survey participants can change simple functions in the software - basic level;
- 20% of participants know one programming language - independent level;
- 5% of participants can create databases, use several programming languages - professional level.

6. "Can you solve problems using digital technologies?":

- 55% of students are able to solve a technical problem when using a new program - basic level;
- 40% of respondents can solve almost all problems using digital technologies - independent level;
- 5% of students solve all problems when using digital technologies - professional level.

7. "Do you constantly update your skills in using digital technologies?":

- 36% of students understand the need for regular updating of skills - basic level;
- 40% of respondents use digital technology skills - independent level;
- 24% of respondents systematically work in the field of digital technologies to improve their professional level -professional level.

The purpose of the survey was to reveal the attitude of those seeking education to the use of the information and digital educational environment of the educational institution, the ability of the respondents to create multimedia content in various formats, to reveal the opinion about the most effective digital tools, to increase the level of digital competence of future specialists, to develop the ability to solve problems when using digital technologies, which arise, etc.

The general dynamics of increasing the level of digital competence of future specialists is not intensive enough, they do not actively create their own digital resources and use the information and digital educational environment of the educational institution, and they do not use a wide enough range of ICT, they do not have the skills to protect personal information and devices, in most activities remain passive about the safe use of digital resources.

The respondents who answered the questions of the online survey noted that the attitude of the education seekers to the use of the information and digital educational environment of the educational institution, the ability of the respondents to create multimedia content in various formats, to express their opinion about the most effective digital tools, to increase the level of digital competence of future specialists, to form the ability to use digital technologies to solve problems that arise, etc. is not effective enough. Respondents attribute the following to the main problems: weak provision of high-speed Internet connection, inadequate access by educational institutions to digital devices, and inadequate management of access to IT infrastructure.

The use of the information and digital educational environment in the educational process of preserving personnel potential, continuous improvement of professional skills; equalizes the conditions for everyone, ensuring equal access to educational materials due to the systematic use of the information and digital educational environment for the formation of information competence of future specialists in universities.

It should be noted that the creation and implementation of an information and digital educational environment in the practice of higher educational institutions is accompanied by various aspects:

- creation of a single information space of the educational institution as a system with full computerization of all educational units, libraries and their connection to all-Ukrainian and international networks;
- development of automated integrated management systems for structural subdivisions of a higher educational institution: educational department, dean's office, department;
- development of an integrated system of electronic educational and methodological complexes, which would cover all educational disciplines of each faculty and institute of a higher educational institution;

– development of effective methods of using the educational information environment.

Solving these tasks requires, first of all, sufficient material and technical support and financing. In addition, the solution of these problems is significantly hindered by the lack of a systematic, centralized approach to the creation and formation of an educational information environment in higher educational institutions and the insufficient readiness of the teaching staff to use it in their professional teaching activities.

Barriers to implementation: Despite potential benefits, effective implementation of digital educational environments is hampered by challenges such as limited access to high-speed Internet, lack of digital devices in educational institutions, and inadequate management of IT infrastructure.

Recommendations for the future: To fully exploit the potential of digital educational environments, it is recommended to invest in technological infrastructure, develop teacher training strategies in digital skills, and promote the creation of high-quality and relevant digital educational content.

Conclusions

The information and digital educational environment of the educational institution is characterized and its necessity in the global space is shown.

Ways of using information technologies in education and their didactic possibilities are revealed, and key characteristics are listed. The purpose and tasks of the information and digital educational environment of educational institutions of modern society are specified.

The process of building an information and digital educational environment of an educational institution is shown. The most important software of the information system of professional training, which should be in the information and digital educational environment of the educational institution, is highlighted.

The necessary conditions and organizational principles of creating an effective information and digital educational environment of an educational institution are substantiated. The main goals and recommended tasks regarding the formation of the information and digital educational environment in the educational institution are proposed.

An experimental study was conducted to find out the level of digital competence of future specialists and the role of the information and digital educational environment in the educational institution.

During the experimental work, we developed questions for self-assessment by future specialists – students of higher education, aimed at clarifying the level of their digital competence and the role of the information and digital educational environment in the educational institution. Questions were formed based on international approaches, in particular, based on the document "Digital Competence Framework for Citizens: Eight Levels of Mastery with Examples of Use" (DigComp 2.1: Digital Competence Framework for Citizens). The digital competence framework includes such levels: professional user, independent user, and basic user. The Digital Competence Framework includes five areas of this competence: digital literacy and information, digital content creation, collaboration and communication, problem-solving, and safety. The respondents' self-assessment was built on these levels and areas during this study.

The general dynamics of increasing the level of digital competence of future professionals is not intensive enough, they do not actively create their own digital resources and use the information and digital educational environment of the educational institution, and they do not use a wide enough range of ICT, they do not have the skills to protect personal information and devices, in most activities remain passive about the safe use of digital resources.

The respondents who answered the questions of the online survey noted that the attitude of the education seekers to the use of the information and digital educational environment of the educational institution, the ability of the respondents to create multimedia content in various formats, to express their opinion about the most effective digital tools, to increase the level of digital competence of future specialists, to form the ability to use digital technologies to solve problems that arise, etc. is not effective enough. Respondents attribute the following to the main problems: weak provision of high-speed Internet connection, inadequate access by educational

institutions to digital devices, and inadequate management of access to IT infrastructure.

Further research is needed to assess the long-term impact of digital educational environments on students' academic and professional performance, as well as to explore innovative strategies to overcome implementation barriers and ensure equity in access to these tools.

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