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IMPLEMENTATION OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN THE EDUCATIONAL PROCESS OF A MODERN INSTITUTION OF HIGHER EDUCATION

Introduction

In today’s world, one of the most important priorities for the development of higher education in Ukraine is the active integration of information and communication technologies (ICT) into the educational process and the digitalization of education. The globalization of educational and scientific activities, based on the introduction and use of ICT, demonstrates that research in this area will always be relevant. ICT not only transforms the educational environment but also provides opportunities for lifelong learning, facilitates the exchange of knowledge, and enables the creation of new knowledge and advanced tools for high-quality educational activities.

Purpose, subject and research methods

The purpose of this study is to determine the stages of information and communication technology (ICT) implementation in the educational process of higher education institutions (HEIs) of Ukraine, as well as trends in the development of the educational process in modern conditions. Additionally, this study seeks to develop a mechanism for the informatization of modern HEIs.

Research subject. The theoretical and applied aspects of the information and communication technologies implementation into the educational process of modern institutions of higher education.

Research methods. The data from the regulatory and legislative base of Ukraine, fundamental provisions of pedagogical and psychological methods, management, materials from monographs, periodicals from Ukrainian and foreign literature, reference sources, scientific developments of modern scientists, as well as empirical research methods on the problems of introducing information and communication technologies into the educational process of modern institutions of higher education were used during the study.
Research results

The educational sphere is one of the most important priorities of every country, since education occupies a decisive place in the intellectualization of work, which affects the transformation and modernization of the modern world, the implementation of the "Education for Life" program, which takes place due to the introduction of information and communication technologies into the educational process. The term "Information and Communication Technology" (ICT) is often used to emphasize the role of unified technologies and the integration of telecommunications, computers, software, storage and audiovisual systems that enable users to create, access, store, modify and transmit information.

Based on an analysis of pedagogical and scientific-methodical literature, the periodization of stages for introducing ICT into the educational process of higher education institutions in Ukraine has been determined. The periodization is based on various criteria, including the degree of scientific and technical progress, general patterns of societal development, socio-political and legislative changes in the state, reforms in the education system of Ukraine, and the introduction of new educational programs. Researchers have identified three stages of ICT implementation in the educational process of higher education institutions in Ukraine [1]:

- electronicization;
- computerization;
- informatization.

The first stage (50-70 years of the 20th century) - the electronicization of education - was characterized by the widespread introduction of electronic means and computer technology into the educational process, as well as a number of processes that became a prerequisite for the later introduction of information and communication technologies in education.

The second stage (1980-1990) - computerization of education - was characterized by the use of computers and software, the development of information competence among scientific and pedagogical staff, and the intensification of computerization in higher education institutions. This stage was marked by the emergence of dialogic interaction between humans and computers, which opened up new and extensive opportunities in the field of education.

The third phase (2000-2010) – the informatization of education - is characterized by the wide use of modern computers, high-speed storage devices with a large capacity, new ICT, social networks, and services.

The analysis of scientific and pedagogical experience and scientific literature shows that the use of ICT will make it possible to build the educational process more effectively by enabling:

- archiving significant volumes of information;
- providing easy access to information sources;
- transmitting information over long distances;
− providing the possibility of multiple repetitions of fragments of educational material;
− managing images on the screen;
− automating management activities;
− diversifying information presentation forms;
− using multimedia tools.

The current stage of the development of the educational process is characterized by the following trends:
1) formation of a system of continuous education throughout life;
2) creation of a single information space;
3) synthesis of means and methods of traditional education with information and communication technologies;
4) active implementation of new means and methods of education, which are oriented towards the use of ICT;
5) creation of a system of anticipatory training.

Information and Communication Technology (ICT) initiate the development of new approaches to learning technologies and opens up additional opportunities for creating computer systems for learning and knowledge control.

The use of ICT fundamentally changes the role and place of the student and the scientific-pedagogical worker in the educational process. The student acts as an active participant in the process of cognition, "subject-subject" information interaction, a source of information, and a performer of internal cognitive actions [2, 3]. A scientific-pedagogical worker "ceases to be a mere 'retransmitter' of knowledge, but is a co-creator of modern learning technologies devoid of lecturing and preaching" - a mentor who coordinates, models the cognitive situation, works together with students to solve it [3, 4].

The introduction of ICT into the educational process involves their use for the development of methodology and raising the level of teaching of academic disciplines. The use of ICT significantly improves the management of the educational process and increases its pedagogical effectiveness. The readiness and ability of the scientific and pedagogical staff to introduce information technologies into the educational process and learn the tools and appropriate methods of their use are crucial factors for the high-quality and successful use of ICT in education.

Researchers have highlighted several advantages of using ICT in the educational process [3, 4, 5]:
− organization of cognitive activity through modeling;
− simulation of typical professional situations using multimedia;
− application of acquired knowledge in scientific research;
− effective training of knowledge, abilities, and skills;
− automated control of learning results;
− providing feedback;
− development of creative thinking;
− the possibility of combining visual and audio forms in educational programs.

The introduction of modern ICT into the educational process has led to the emergence of the term "informational and educational environment." This term refers to a set of computer tools and methods used to implement the educational process. The composition of computer tools includes hardware, software, and information components. The methods of use of these tools are regulated by the methodical support of the educational process. The construction of a unified information and educational environment based on modern information technologies brings new opportunities to the educational process. It combines high economic efficiency and flexibility with the wide use of information resources. This allows for a significant expansion of the possibilities of traditional forms of education and the creation of new effective forms of education.

The unified information environment enables optimal and high-quality solutions in the field of educational activities such as: planning of the educational process according to various programs, levels and forms of education; organization of educational events in electronic form; presentation of educational material and reference information; the transition from the dominance of reproductive activity to creative and consultative activity; providing access to the participants of the educational process to information related to the planning, organization and monitoring of the educational process; ensuring communication interaction between educational and pedagogical workers, students and management staff; effective use in the meaningful process of educational and methodical complexes and materials that are constantly updated.

In this context, we will explore the process of introducing information technology into a modern institution of higher education, including its various components and the necessary material and technical resources.

The first step involves the implementation of courses in informatics and information and communication technologies, which will address the issue of computer competency among students in the institution.

The main task of the first stage is to organize the teaching of a continuous course of informatics, information technologies, and special informatics by specialty throughout the entire learning process.

Collaboration among scientific and pedagogical workers makes it possible to adapt current programs to the needs of higher education institutions and the requirements of the labor market, and to carry out their annual correction while complying with the State Standard.

The main task of the second stage is to use ICT in the process of studying various disciplines.
The main goal is cooperation between scientific and pedagogical workers who specialize in computer training and those who teach other subjects. An important component of this stage is accumulating experience in the use of ICT at the level of higher education institutions. Therefore, one of the main tasks of this stage is to provide training and improve the qualifications of scientific and pedagogical workers in higher education institutions.

For example, providing opportunities for scientific and pedagogical workers to undergo advanced training in a distance form is a great way to ensure continuous professional development and improve their digital competence. It allows them to select the content, forms, methods, and teaching tools that are most relevant to their field and to keep up with the latest advancements in technology and teaching methods.

An important component of the informatization of the educational process at the second stage is the accumulation of experience in the use of ICT at the level of higher education. The task is to ensure that information technologies are organically integrated into the activities of each scientific and pedagogical worker. This process is long-term, and involves the exploration of various forms and methods of using ICT, as well as the development and adaptation of necessary software products to help improve its effectiveness.

At the third stage, the broad integration of ICT in the educational process enables the integration of various disciplines and allows for individualized education.

The 4th stage – transformation of higher education institutions. The main task of this stage is the introduction into practice of systematic procedures that provide an individualized solution to the entire set of tasks of the educational process.

The analysis of the use of ICT in the educational process leads to the conclusion that it can enable the following:
- activation of students' cognitive activity and independent work.
- provision of positive motivation for learning through interactive and hypertextual dialogues;
- conducting classes at a high aesthetic and emotional level;
- ensuring a significant level of differentiation in education;
- increasing the volume of work;
- improving knowledge assessment and control;
- rational organization of the educational process;
- developing skills in search activity;
- providing access to various search engines, electronic libraries, and other information systems and resources.

Material and human resources invested in ICT-based education may be wasted if students and teachers/researchers are not properly prepared for this form
of education. All available electronic resources should be used in the educational process.

The use of ICT in modern higher education institutions should be carried out in the following ways:
- as a subject of study;
- as a means of education;
- as a means of managing the educational process;
- as a tool for managing research and scientific-methodical work.

The use of information technologies in the educational process helps to expand communication skills, master ICT, and develop the information and communication competence of both teachers and students [6, 7].

Based on the analysis of psychological, pedagogical, and technical literature, as well as dissertation research, the following areas of professional competence development for teachers and researchers in higher education institutions of Ukraine have been identified:
- improvement of teaching and research methods to meet the requirements of modernizing the educational and scientific process;
- development and application of tools for digitalizing the educational process;
- implementation of innovative learning technologies, such as creating an information environment in higher education institutions, using electronic educational and methodical complexes, applying interactive learning methods, innovating the system for controlling and assessing training results, using modeling and multimedia training, and using virtual laboratories.
- increase the quality of educational services;
- improvement of the educational and scientific process by adopting a person-oriented approach to organization;
- provision of methodical support and professional training to enhance qualifications;
- increase the competence of higher education graduates to meet workforce demands;
- organization of scientific research work among students;
- usage of ICT to manage higher education institutions and automate library work;
- application of innovative training methods to improve the qualifications of scientific and pedagogical workers;
- collaboration and partnerships between higher education institutions and other organizations.

Empirical research indicates that the field of higher education is rapidly evolving, with mixed and distance learning becoming increasingly prevalent. This shift can be attributed to the growing use of ICT in education and the digitization of society.
Experiential learning of universities in the United States, Canada, Great Britain, and other European Union countries, it becomes clear that higher education institutions are no longer limited to their local areas. The traditional concept of cyclical learning, where students must enroll on a specific schedule, is also disappearing. As the university becomes a global organization, the student is becoming the focus of the educational process, rather than the professor. Professors now serve the needs of the students, rather than the other way around.

Distance education encompasses a broad spectrum of educational programs and courses, including non-accredited professional development courses and accredited higher education programs. These programs offer students the opportunity to interact closely with their teachers and peers, similar to offline education. In analyzing the features and principles of building distance learning systems, V. Kremen concluded that distance learning is a powerful tool for solving modern tasks of education modernization.

In the field of higher education, organizational structures involved in distance learning can be divided into four main models: supplementing traditional university education, consortia, agreements, and virtual universities. In Ukraine, organizational structures of the first and fourth types have been predominantly developed.

Specialized information systems, known as learning management systems, are commonly used to facilitate distance learning. These systems consist of modules that enable comprehensive distance learning. Some of the most widely used learning management systems include Moodle, Ilias, Webtutor, IBM Learning Space, eLearning 3000, WebCT, and KhPI Web Class. Despite differences in their interfaces, functionalities, and resource requirements, these systems share a similar structure. They are built on the principle of modularity and the division of users into groups according to their roles in the educational process.

There are several higher education institutions are well-known in the field of open distance education: the National University of Distance Education in Spain (Universidad Nacional de Educación a Distancia, with 58 educational centers in the country and 9 abroad), the Open University of the Netherlands, the Center for Open Education in Spain (Centro de Enseñanza a DISTANCIA), and the Hagen Distance University in Germany. Among them, Penn State University is widely recognized as a leading authority in the field of distance education. UNESCO used Penn State University's experience to develop the concept of a virtual university.

The software architecture of the "Virtual University" consists of systems that are distributed free of charge. This is a significant advantage that simplifies the process of introducing them into the educational process. O. Zachko and T. Rak define the virtual learning environment as an environment "that facilitates the emergence and development of processes of informational and educational interaction between students, teachers, and ICT tools, as well as the formation of
students' cognitive activity, provided that the environment's components are filled with the subject content of a certain educational direction”. The main requirements for the virtual environment are as follows: personalization - the ability to reproduce personal characteristics that allow us to judge the character of people participating in communication; expressiveness - the ability to convey non-verbal information; constructiveness and creativity - the ability to create objects within the virtual environment and manipulate them; persistence - the ability to store objects reproduced in the environment for a certain period; and community - the possibility to create groups based on interests using information media.

Alternative criteria for evaluating virtual environments can include immersion and interactivity, which are used to classify information media based on their ability to efficiently convey information about the semantics of the virtual environment to the person who is perceiving it. Immersion in the virtual environment refers to the degree of information expressiveness, while interactivity refers to the degree of independence that individuals have to take actions within the virtual environment.

The advantages of a virtual learning environment include: building learning around the student (the virtual shell allows students to learn anytime, anywhere, according to their individual learning style, interests, schedule); compliance with the realities of the surrounding world (the ability to learn in real time); cooperation (the use of electronic discussions (forums), e-mail, conferences stimulates interaction, cooperation, teamwork).

The advent of digital technologies over the past two decades has radically changed the world and will continue to do so. Technology is driving profound changes in the professional and private lives of people across Europe and the world, affecting all aspects of society. It is now an integral part of the way people communicate, work, learn, and access knowledge and information.

The main directions of digitalization in education include the creation of digital platforms and educational resources with support for interactive and multimedia content, tools for automating processes in educational institutions, and the development and implementation of innovative computer-oriented teaching aids and equipment to create digital learning environment (such as multimedia classrooms, STEM laboratory centers, inclusive classrooms, and mixed learning classrooms). Additionally, efforts are focused on providing large-scale access to the Internet in classrooms and educational institutions of all levels, as well as the development of distance education using cognitive and multimedia technologies [9].

The analysis of literature and trends in the implementation of ICT in higher education [8-10] led us to identify two additional stages in the educational process:
– the fourth stage (2010-2020) was characterized by the virtualization and digitization of education, marked by the development of web-oriented and distance-learning technologies;

– the fifth stage (beginning of the third decade of the 21st century) is characterized by the globalization of education, which is driven by the development of cloud-based learning technologies and the popularization of global educational digital platforms.

In the increased globalization conditions and dynamic growth of higher education worldwide, modern institutions must establish a strong brand to remain competitive in attracting students, employees, and international partners.

Internationalization of student youth and teachers, along with the development of global partnerships with leading institutions, not only enhance the quality of education, teaching, and research but also significantly contribute to the overall well-being of students.

The development of educational partnerships is an important element of the European strategy of cooperation with other regions of the world. The widespread availability of high-quality educational resources and the ability to adapt these materials to specific conditions are driving significant changes in educational levels in many countries, especially in developing countries.

Thus, the analysis of the process of introduction and use of Information and Communication Technologies (ICT) in the educational process in higher education institutions of Ukraine enables us to identify five stages (see Drawing).

![Drawing](image)

**Fig. 1.** Drawing. Stages of ICT implementation in the educational process of higher education institutions of Ukraine.  
*Source: developed by author.*

Therefore, the difference in the quality of education and access to it determines global, regional, and local cognitive and information gaps, as well as the current profile of the stratification of national economies and their potential for further development [10].
Conclusions

Based on the results of the analysis of the use of ICT in the educational process of higher education institutions in Ukraine, a periodization of the stages of ICT introduction was developed. The analysis identified consistent trends, such as electronicization, computerization, informatization, virtualization and digitalization, as well as globalization of education. This periodization was developed using criteria such as the degree of scientific and technical progress, general patterns of societal development, socio-political and legislative changes in the state, education system reforms in Ukraine, introduction of new educational programs into educational system of Ukraine, and the digitalization of society.

The following directions are priorities for the introduction of ICT in modern higher education institutions in Ukraine to ensure highly qualified student training: material and technical support, computer and didactic support; the establishment of a system of independent work, mixed and distance learning based on the information and educational environment of the institution and the creation of a 'Virtual University'; increased focus on classes that develop analytical and prognostic thinking; use of games, situational and virtual simulations; promotion of communication and dialogue means and forms in the organization of the educational process; development and implementation of effective systems for diagnosing and controlling students' competencies in their chosen field.

It is worth noting that ICT are effective tools for developing creative potential, improving the quality of student training, increasing the professional competence of academic and teaching staff, and enhancing management activities in the educational process.

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Abstract

Based on an analysis of pedagogical and scientific-methodical literature, this study identifies the stages of information and communication technology (ICT) implementation in modern Ukrainian higher education institutions (HEIs), as well as trends in the development of the educational process in the context of society's digitalization. Additionally, the study examines the advantages of using ICT in the educational process and justifies its implementation, emphasizing the possibilities of computer-based education systems. A mechanism for the informatization of modern HEIs is proposed, including its components, necessary materials and technical resources. The study also identifies areas of professional competence development for scientific and pedagogical workers under the conditions of ICT implementation in HEIs and highlights the advantages of virtual educational environments.

Keywords: educational process, information and communication technologies, implementation stages, higher education institutions, distance education, virtual education

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