

Information Technologies in Education: Current Realities and Development Trends

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Abstract

Objective: educational process in the XXI century is impossible without the proper knowledge of information and communication and digital technologies. Educational institutions of different levels of accreditation should become a reliable guide to obtain the necessary skills, the development of information literacy to create future competitive specialists not only for the labor market in Ukraine but also internationally. Methods: the following research methods were used to achieve the goals: analysis of theoretical materials; empirical analysis. Results: the article is devoted to the study of the role of information technology in the educational process, the current state of Ukrainian education. The processes of informatization of educational space in Ukraine as an integral part of the requirements of the information society of the third millennium are considered. Emphasis was placed on the study of the international experience of different countries in this direction. Ways in which foreign countries transform education to improve its quality have been analyzed. The basic tasks of deepening informatization, problems, and prospects of development in the national educational system and foreign study are highlighted. The results of studies of the level of knowledge of information technologies by students of Ukrainian educational institutions by international and domestic programs are described. The need for a conceptual approach to the organization of the educational process in Ukraine, taking into account the experience of European countries is emphasized. Scientific novelty: the main newest introductions to improve the informatization of Ukrainian educational institutions were noted. Conclusions: active use of information technologies in the educational process contributes to the effective formation of skills and abilities of Ukrainian and world educational institutions.

Keywords:

Information technology, digital technology, computerization, education, educational process

1. Introduction

American scientists William Strauss and Neil Nowe [15] developed a generational theory, where they presented Generation Z (children born between 1994 and 2012) as a

modern information-digital society. For these children, the perception of the world takes on significantly different realities.

They were almost literally born with a communication device in their hand, and the digital world is intertwined with the real world and is already perceived differently, on a more intellectual and productive level. That is why the active use of information technology is the leading area of improvement in the educational process. The modern high-tech world dictates its own rules. Both students (applicants for education) and teachers (generations B 1977-1944, X 1966 - 1976) must quickly get used to modern realities. And information technology will help to create a new, unique learning environment to discover and improve the cognitive-educational environment [5]. The relevance of the article lies in the need to study the fundamental role of information technology in education. The aim is to study the status of the use of information technology in the educational process, efficiency, and effectiveness. Performing an analysis of prospective development.

2. Methodology

To implement the objectives the following research methods were used: analysis of theoretical materials – the study of psychological and pedagogical literature with the problems of the state of information technology in education; familiarization with domestic and foreign experience of ways and methods of information technology in education; systematization and synthesis of scientific, scientific and methodological sources with the research problem, facts and regularities of information technology in educational institutions; empirical analysis - conducting questionnaires, surveys, interviews with students and teachers, observation, conducting a pedagogical experiment (determining the level of knowledge of information technology by participants in the learning environment).

3. Results

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The modern world and society are rapidly developing in all spheres. Education is no exception. In Ukraine, the active development of informatization and digital development began with the decision of the Cabinet of Ministers in 2011, which stated: “achieving digital and informational transformation of existing and creation of new sectors of the economy, as well as the transformation of spheres of life into new, more efficient and modern”. In this decree, the link of education occupies a certain place [9].

The purpose of the use of information technology in educational institutions is: the development of intellectual abilities; increasing the level of information competence; expanding opportunities for learning the latest technologies; access to electronic resources and services; ensuring the acquisition of knowledge in any place and at any time; the formation of information culture [8].

The first use of these terms for education occurred in 2015 in the resolution “Transforming Our World. The 2030 Agenda for Sustainable Development”. [11].

In 2020, the Digital Agenda of Ukraine explained the basic concepts of information competence, which defined the path to the European approach as a further priority development [14].

In foreign countries - Europe, the USA, Japan [5], the term “information competence” appeared in 2015. It included: attitude and awareness in the field of information and computer technologies; a set of knowledge, skills, and attitudes necessary to use technology; building knowledge

of effective, efficient, critical, creative learning to provide opportunities; skills to work in information and communication environment.

The Science and Knowledge Service of the European Commission of the EU Science Center presented information technology in education as conscious, critical cultivation of digital technologies in work, free time, and communication.

The world monitoring carried out in 2019 showed that the advanced places of introduction and use of information technologies were occupied by Iceland, South Korea, Switzerland, Denmark, Great Britain, Hong Kong, the Netherlands, Norway, Japan, Sweden, Luxembourg. Ukraine ranked 79th in this rating [4].

The main goal of the Ukrainian educational institution is to graduate a competent graduate, capable of applying the knowledge gained in practice, saturated with digital means of communication, management, education, business. According to the goals set, the educational process is being reformed to meet the needs of a computerized society. Thus, the requirements for teachers are increasing, in particular, their information competence. Teachers must ensure the development of a wide range of all components of informatization: from media literacy to processing and critical evaluation of informative data. Experts at the World Economic Forum in Davos in 2020 even identified the skills inherent in the modern educator by 2025.

The European educational structure aims to develop the digital competence of the teaching staff of educational institutions. That is, the development is aimed at: information literacy, working with databases, communication, use of electronic content, responsibility, problem-solving [2].

The European Commission has outlined a vision for the informatization of education between 2021 and 2027. This is a definite plan for providing quality cooperation at the European level, which has two strategic priorities [15].

1. Assistance in the development of a highly effective information educational system (infrastructure, networks of digital capabilities; effective planning and development of information capacity, including modern organizational capabilities; confidence of teachers with a high level of information literacy; quality learning content, user-friendly tools, and secure platforms). To meet this challenge it is necessary: to start a dialogue with the Member States of the European Union with proposals that will contribute to the development of information education from 2022; develop a European content system for informatization of education; support a gigabit connection for schools; attract all funding opportunities to purchase equipment, training programs, and platforms; support the Erasmus+ digital transformation plan, the Erasmus Teacher Academy, the SELFIE teacher self-

assessment tool; develop recommendations on the ethics of using artificial intelligence; support the Horizon Europe innovation study [15].

2. Improvement of information skills and competencies (development of information literacy from early childhood; training of new professionals). To solve the second strategy it is necessary: to develop general recommendations on the importance of the development of information technologies in education; to update the European system of information competencies, with the inclusion of artificial intelligence; to create a European certificate of information skills; encourage new educators; participate in the International Computer and Information Literacy Study, which will be able to collect transnational data by 2030 on the information skills of students 13 - 14 years old, at least 20% with informatics and computerization abilities [8]. A significant breakthrough for Ukraine was the New Ukrainian School Concept - NUS for the period until 2029 [13]. This concept of development of general secondary education involves confident use of information and communication technologies, learning the basics of programming, algorithmic thinking, working with databases, Internet safety skills, cybersecurity, and understanding the ethics of working with information.

To form technical, scientific-theoretical support of STEM-technology education the process of development, dynamics, and efficiency of innovations implementation, identification of problems, and forecasting of trends in the development of informatization of the educational process began. The action plan for the development of STEM-education in Ukraine was approved by the MES and provided for implementation until 2027 [11].

According to certain modern educational trends, we can identify innovative technologies and methods relevant to education in Ukraine:

- integrated learning (a combination of several science fundamentals);
- research and cognitive activities;
- project-based learning;
- collaborative learning;
- flipped classroom technology;
- virtual, mixed, and augmented reality;
- 3D printing;
- medical literacy;
- problem-based learning;
- distance, dual blended learning;
- self- and self-assessment;
- making various items with their own hands;
- technologies of inclusive education;
- microlearning;
- distance learning technologies;
- technologies of critical thinking formation;

- technology of using own gadgets (the concept of "bring your own device");
- technologies of formative assessment;
- the use of e-learning game technologies [14].

Regarding the global, all-Ukrainian use of information technologies in the educational process, the relevance of educational programs that will facilitate the adaptation of applicants for education to life in a society of economic knowledge. As part of the implementation of the educational space, "I'm a researcher" were created and tested innovative training programs for the effective formation of mathematical competence and junior high school. The basis for their implementation is the use of active learning methods, in particular research, and information technology. During the implementation of the project the following results were achieved:

- developed and tested a pedagogical model for organizing students' educational and research activities using informational approaches;
- developed and approved for use in general education institutions by subject commissions of the Scientific and Methodical Council of the Ministry of Education and Science of Ukraine a series of tutorials "I'm a researcher" for students in grades 2-9 (about 30 teaching aids), a variable course "STEMLab" for students in grades 5-9
- Information and counseling centers have been organized at eight institutions in Zhytomyr, Zaporizhzhia, Mykolaiv, Odesa, Sumy, and Kyiv oblasts;
- teachers are trained at seminars and trainings, both online and offline;
- an electronic resource for information support of the project on the web platform <http://yakistosviti.com.ua> was developed;
- a platform for the professional development of the project participants, the presentation of the implemented educational practices, exchange of experiences within the framework of the Ukrainian STEM-school;
- organized interaction of project participants using information technology on the platforms Zoom, Google Meet, social network Facebook, cloud services Google for Edu [6].

A thirty-hour professional development program was developed to prepare teachers for the "I'm a researcher" system, and online training was organized and conducted for all teachers working with the author's curriculum.

An educational resource with a permanent "Pedagogical Workshop" is popular now. Within its framework, scientific and practical seminars, round tables, a Marathon of STEM lessons, an information coffee house, master classes were held. During these events, the participants have the opportunity to learn the experience of the winners

of All-Ukrainian competitions of professional excellence, innovative educational projects, in particular the competition for the Global Teacher Prize Ukraine, Best Publication, Best Lesson, Teacher of the Year by the popular science magazine "KOLOSOK", all-Ukrainian festival "Science on Stage" [1].

Systematically conducted research on the implementation of information education in Ukraine. Analysis of the results of the research has allowed us to identify new forms and methods of work that appeared as a result of the development of informatization, to popularize and enrich the concept itself.

In 2021, 97.5% of respondents named information technology as an important area of implementation of the conceptual foundations of NUS, more than half (up to 49%) consider innovation as a pedagogical technology of education, an effective process for quality education in the NUS, by increasing the number of specialists in the future professions [11].

Researching the topic of informatization of education provide an opportunity to identify the basic problems that, according to the interviewees, delay the development of domestic education. [10]. The majority of respondents consider information technology as an integral part of the educational process. So, it is necessary to start a network of information centers, laboratories (including virtual), which create conditions for the formation of science-oriented education based on the modernization of various profiles. Analysis of the survey results showed that most cities/districts in Ukraine have opened information technology centers. According to the respondents, 87% of the centers/laboratories were created based on EHS institutions, 5% of the institutions of out-of-school education, 3.8% of pre-school education institutions, 2.5% of EHE institutions, and 1.7% of postgraduate teacher training institutions [11].

4. Discussion

The national system of all levels of education (primary, secondary, higher, vocational, and continuing education) lays the foundation for successful self-realization and improvement of the graduate and helps to adapt to the rapid pace of life. The main focus of education is the development of the national school, built on the principles of the twentieth century. All principles of improvement focused on global trends in the transformation of education. In recent years, educational public policy is aimed at overcoming problems and challenges. Among its priorities is the creation of fundamentally new methods of mastering academic disciplines. And this is impossible without studying foreign experience and approbation of it in Ukrainian educational institutions.

In recent years, Ukraine has been actively taking a course to improve the level of education and provide for European approaches. In 2018, Ukraine conducted for the first time the international study of the quality of education PISA-2018, where one of the types of testing was informatization [11]. Subsequent studies were planned already in 2021 and 2024. The test showed the following results and perspectives for the development of students' information literacy:

Table 1: Comparative analysis of the level of information technology proficiency of Ukrainian students in the international system PISA [11]

Level of proficiency in information technology	2018, %	Prospect 2021, %	% of the difference
High	46,4	53,2	6,8
Medium	41	43,6	2,6
Sufficient	11,4	2,2	9,2
Beginning	1,2	1	0,2

Source: summarized by the authors based on PISA 2018 analysis

The results of the study showed that in three years the students of Ukrainian educational institutions should increase the high and sufficient level of knowledge of information technology, and the average and low levels of proficiency should decrease. Such indicators are comforting because there is an increase in information literacy among students.

According to the concept of information development of education, some items should be noted: acquisition of new content in the educational space, based on the formation of competencies necessary for successful self-realization at the global level; motivation and development of teachers; information literacy; partnership pedagogy; Ukraine's participation in international comparative studies; development of technical means for implementation of all the above-mentioned points.

The success of reforms in the development of information technology is confirmed by monitoring studies conducted three years in a row by the DNU Institute for Educational Analytics. Based on three years of experience, more than half of the teachers note that they themselves (55.31%) and their students (61.33%) enjoy working/learning with the help of information technology. This is also confirmed by 63.8% of high school parents. In addition, according to teachers (58.3%) and parents of students (48.8%), high school students make equal progress in acquiring information competencies [11]. Based on the data of monitoring studies at the all-Ukrainian and international levels, we can state that the reforms in the direction of the development and prospects for the use of information, information and communication, and digital technologies

are successful, and its achievements should be consolidated and developed in the years to come.

To solve the problem of inequality of educational institutions' access to information and communication technologies, by 2023 the MES plans to develop a unified information learning platform [11]. This will be an electronic space to work both online and offline. With electronic classrooms, educational and methodical material, assessment models.

It is also planned to develop software for the formation of certificates, diplomas, and applications of European standards. This will help future employers to check educational documents on the EHBO website.

Through the use and improvement of information technology, it is possible to form a functional learning environment on a unified basis, through which it is possible to achieve the activation of the educational process, to form the skills of collective work on educational projects, moderate the joint work of students and teachers, effectively handle significant amounts of data full training and self-realization of the future specialist in the information society, putting before its members new, modern requirements.

5. Conclusions

The informatization of the educational process entailed the active use of computer technology, which had positive and effective growth in learning activities at all levels and contributed to the formation of a range of professional competencies. The digital component became the main component of the professional-pedagogical activity.

A significant achievement in the development of the education system in independent Ukraine was the process of end-to-end information education and the rapid development of communication technologies, covering both learning technologies, educational content, and education management system.

By global trends, Ukraine is rapidly developing educational information systems and educational databases that contain information on the state of education and participants in the educational process: Unified state electronic database on education, PAC "AICOM" (modernized ITS "DISO"), AS "IRC", information educational systems Ukrainian Center for Educational Quality Assessment and State Educational Quality Service. Educational challenges have led to the emergence of powerful new information resources for effective online learning (e.g., the All-Ukrainian School Online platform). Availability of online access to educational information for all participants of the educational process, as well as open data from integrated information systems of education, which collect, process, store, and disseminate information based on individual depersonalized data of teaching staff

and applicants, is a necessary condition for the transition to a decentralized public-public management model at all levels of education, the introduction of electronic management in the education system.

Thus, we can conclude that the active use of information technology in the educational process contributes to the effective formation of skills and abilities of future graduates of Ukrainian and world educational institutions.

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