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INFORMATION TECHNOLOGIES IN SCIENCE AND EDUCATION

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Abstract

Modern IT is considered as an active tool both in the educational sphere and in the sphere of scientific research, opening new opportunities and prospects. IT plays an important role in providing information interaction between people, in the systems of preparation, processing and distribution of information, in the processes of obtaining and accumulating new knowledge. The article reveals the essence, content and historical aspects of the use of information technologies in the educational process, characterises various approaches to the classification of information technologies. The authors present theoretical and practical issues of information technologies in science and education. The main problems and prospects of development of information computer technologies are considered. Informatisation of education should be ahead of informatisation of other spheres of social life, as social, psychological, general cultural and professional prerequisites for informatisation of the whole society are laid in this sphere. In this regard, the problem of expanding the use of information technologies in the modern educational process is of particular relevance.

Keywords: Computer technologies, IT, information interaction, science and education

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1. Introduction

Informatisation of education presupposes the existence and education of professionals with high information culture, analytical skills and humanistic value system (Kondratiev, Boran-Keshishyan, et al., 2019).

In the conditions of informatisation of modern Russian education, new information technologies can be used by a teacher practically at all stages of the educational process: in the preparation of theoretical material, in the creation of information and methodological support for the discipline. This also includes the development of demonstration materials for the class, the testing of students' knowledge, for the collection and analysis of statistics of academic performance. This list can be modified and expanded by a teacher in accordance with the specifics of teaching activity (Dedeneva & Aksyukhin, 2016; Daceva, 2019; Griban, 2014; Labuz & Mazaeva, 2016; Mitrofanov, 2018; Tenischeva et al., 2019).

The development of an individual's information culture remains an area that requires in-depth study and the development of effective strategies. With the growing importance of digital literacy, there has been an urgent need to expand opportunities to create an information culture among generations whose education preceded the introduction of personal computers and widespread access to the Internet (Savchenko & Popova, 2012). For the successful formation of an information culture, it is necessary to create an information and development environment that will contribute to the development of both individual aspects of this culture and its integrity. Modern trends in education are characterized by the widespread introduction of information and communication technologies, covering all the main components of the educational process. This information and development environment should be aimed at:

i. Development of critical thinking and information evaluation skills
ii. Formation of skills in searching, processing and presenting information
iii. Creating opportunities for interaction and collaboration in the digital space
iv. Raising awareness of information security and ethics issues
v. Providing access to various sources of information and educational resources

The implementation of these tasks requires an integrated approach, combining the efforts of teachers, researchers, educational program developers and representatives of public organizations. Only through joint efforts can we create a favorable environment for the formation of an information culture and prepare the younger generations for successful navigation in the modern digital world (Dedeneva & Aksyukhin, 2016; Griban, 2014; Labuz & Mazaeva, 2016; Mitrofanov, 2018; Tenischeva et al., 2019).

Information technologies are an integral part of the scientific direction "Informatics" and are based on its achievements. But nowadays it is not enough to possess information, it is necessary to apply and realise it. This task is solved by information technologies, the main purpose of which is to process information of various types.

On the basis of information technologies, the task of automating information processes is solved. Information, as a product of information technology, is structured and formed in the form of knowledge. The experience of implementing information technologies confirms their high economic efficiency for many spheres of application. Vivid examples are electronic document management systems and the

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organisation of distance learning on the basis of modern telecommunication and information technologies.

Progressive advances in information technology (IT) are catalyzing the creation of a digital ecosystem in which computer networks and telecommunications capabilities serve as the basis for organization and management in all areas of activity. The education sector is no exception, integrating IT into its curriculum at all levels. At the primary stage of education, in schools, IT enhances learning opportunities by providing access to virtual classrooms, digital resources and interactive educational programs. Students have the opportunity to develop digital literacy, critical thinking, and problem-solving skills using modern technology. In higher education institutions, IT plays a fundamental role in improving the quality of learning. Students have the opportunity to use advanced technology to conduct research, create presentations, and participate in virtual learning communities. Integrating IT into higher education can enhance learning opportunities by offering flexible study options such as online courses and blended learning. At the stage of postgraduate education, IT acts as an indispensable tool for researchers and teachers. Access to vast digital libraries, powerful computing resources, and specialized software allows scientists to deepen their knowledge and expand the boundaries of human understanding. In addition, IT facilitates collaboration and exchange of ideas among educators and researchers from around the world. Incorporating IT into educational programs at all levels is critical to preparing students for the demands of a dynamic digital world. It develops in-demand skills such as adaptability, innovative thinking and data skills. Integrating IT into education also ensures continuous access to knowledge and resources, expanding educational opportunities for all (Mitrofanov, 2018; Tenischeva et al., 2019).

2. Problem Statement

Education, being a part of culture, today is actively experiencing the processes of global informatisation. The realities of information society development have led to an intensive search for a new educational paradigm that would adequately reflect modern ideas about the goals, ways, means and results of human development in modern conditions of information civilization (Mitrofanov, 2018; Tenischeva et al., 2019).

The development of science and education in the modern world is impossible without the use and improvement of information and telecommunication technologies, which allow the effective use of information resources in various subject areas. Optimisation in many cases automates various processes that are associated with the processes of preparation, storage, processing and transmission of information (Daceva, 2019).

Didactically oriented software tools of today's generation, which are aimed at the use of IT, offer the user a lot of options for individual adjustment. That is, the student in the process of mastering the learning material can independently set the speed of learning, the amount of educational and auxiliary material, focusing on the level of his difficulties, his own capabilities and life goals. The modern stage of computerisation of the educational sector, enriched by the possibility of using IT, is becoming a reality that nowadays already significantly affects the quality, content, teaching methodology and even the methodology of education.

The main directions of IT application in the school's educational process are:

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i. development of pedagogical software tools for various purposes;
ii. development of web-sites for educational purposes;
iii. development of methodological and didactic materials;
iv. development of controlling real objects (training bots);
v. organization and conduction of computer experiments with virtual models;
vi. purposeful search for information of various forms in global and local networks, its collection, accumulation, storage, processing and transmission;
vii. processing of experimental results;
viii. organization of intellectual leisure time for students.

The most widely used classes at the moment are integrated lessons with the use of multimedia. Educational presentations are becoming an integral part of learning, but this is only the simplest example of IT application.

In recent years, teachers have been actively developing and implementing original educational software products (EPP), which to one degree or another reflect the specifics of the subject area, embody the technology of its study and provide opportunities for implementing various forms of educational activities.

Typology of AKI. The typology of educational software products used in the educational process is extremely diverse. It includes:

i. Educational software products designed for studying specific educational material (for example, digital textbooks, simulators).
ii. Learning management systems (LMS) that enable the creation, delivery, and assessment of learning content.
iii. Tools for collaboration and communication (for example, virtual classrooms, forums).
iv. Assessment programs used to conduct tests and tests of knowledge.

Methodological support. Teaching materials for disciplines supported by the EPP are widely available in both printed and electronic formats. They are accompanied by a variety of applications and support programs that complement and enrich the learning process. However, given the abundance of materials on offer, it may be difficult to master them independently. In this regard, teachers, pursuing similar goals, create their own EPPs, implemented in various forms:

i. Multimedia OPPs, presented on CDs and DVDs, are characterized by the use of audiovisual elements, animation and interactive components.
ii. Hypermedia OPPs, available on Internet sites, provide opportunities for non-linear learning, hyperlink navigation, and access to additional resources.

The introduction of author's educational teaching aids into the educational process makes it possible to increase its efficiency, individualize learning and make it more attractive and motivating for students (Dedeneva & Aksyukhin, 2016; Daceva, 2019; Labuz & Mazaeva, 2016).

Postgraduate education is also oriented towards the introduction of IT. The concept and features of the information society are as follows.

Several remarkable inventions can be singled out, which led to gigantic qualitative "leaps" in obtaining, accumulating and using new knowledge:

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i. the invention of writing, which made it possible to record, store and transmit information from one generation to the next;
ii. the invention of printing, which allowed transmitting knowledge to a wide range of users;
iii. the emergence of the telegraph, telephone, radio and television, allowing the rapid transmission and receipt of information at a distance;
iv. the invention of the computer, introduction of computer networks and information communications.

Unlike revolutions in human society, each information "leap" forward did not destroy, but absorbed and improved the achievements of previous stages.

Modern society is called an information society. It means that a significant part of society is engaged in the production, storage, processing and realisation of information, as well as of its highest form - knowledge. The peculiarity of this society is the continuous exchange of information.

The activities of individuals, groups, teams and organisations depend to a large extent on their awareness and ability to make effective use of available information. Before any action can be taken, a great deal of work must be done to collect and process information, comprehend and analyse it. Finding rational solutions in any sphere requires processing large amounts of information, which is sometimes impossible without specialised technical means (Avanesova et al., 2019; Griban, 2014; Tenischeva et al., 2020).

The use of information resources has accompanied human activity, including economic activity, before, but nowadays their role and importance have increased immeasurably. Information resources occupy an increasingly important position among other resources of the enterprise, industry and the national economy as a whole.

Information products and services include databases, software, educational services, consulting, results of scientific research and development, etc. These products and services are exchanged in the information market and are characterised by numerous features at the stages of development, production and circulation.

In order to make the right decisions, business entities need access to relevant information resources. In this case, we can talk about a variety of sources available under market conditions, including those for which we have to pay a lot of money.

Information resources can be divided into internal and external according to the sources of formation and their relation to a particular organisation. Internal resources include information that is created in the process of functioning of the organisation and formed by specialists of its various departments (e.g., reporting). External information resources include information about the state of the external environment in which the organisation operates (e.g., mass media) (Kondratiev, Boran-Keshishyan, et al., 2019; Kondratiev, Khekert, et al., 2019).

The management of information resources, including the organisation of data and the management of data processing, is increasingly becoming a separate management function. All this is connected with such process in society as informatisation.

Informatisation is an organisational socio-economic and scientific-technical process of creating optimal conditions for meeting information needs and exercising the rights of legal entities and

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individuals on the basis of the formation and use of information resources. Informatisation is based on the application of automated information technologies (AIT).

The main tasks of informatisation of society are:

i. modernisation of information and telecommunications infrastructure;
ii. development of information and telecommunication technologies;
iii. effective formation and use of national information resources and ensuring wide, free access to them;
iv. provision of citizens with socially significant information and developing independent mass media;
v. creation of the necessary legal and regulatory framework for building an information society.

The quantity, quality and accessibility of information resources already now largely determine the level of a country's development, its status in the world community and will undoubtedly become a decisive indicator of this status in the future.

3. Research Questions

In education, information technology can be used to improve the quality of teaching, simplify the learning process, increase student motivation and facilitate access to educational materials. In the digital era, schools and universities can use online courses, knowledge testing, learning management systems and many other tools (Avanesova et al., 2019). This allows us to expand the boundaries of the traditional educational model and reach a larger number of students, including those who previously did not have access to educational institutions.

4. Purpose of the Study

In higher education, the study of information technology (IT) plays a multifaceted role, covering different levels of tasks (Pivovarova, 2000):

First level: IT as a tool for learning and cognition

Students learn the fundamental principles of computer science, including:

i. Data structures and algorithms
ii. Database
iii. Computer networks

IT is used as a tool to facilitate the educational process:

i. Online resources such as e-books and textbooks
ii. Virtual experiments and simulations
iii. Learning management software that makes communication and collaboration easier

Second level: IT in professional activities

Students learn IT theory, components and methodology applicable to their future professions.

They develop skills in:

i. Data processing

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ii. Databases and information management
iii. Network technologies and security

These knowledge and skills are vital to succeed in today's technology-driven world.

Third level: Applied IT for specialties

Students receive specialized IT training that is directly related to their chosen profession.

They are learning:

i. Software development in specific subject areas
ii. Application of IT in specific industries
iii. Information systems management

This training prepares students to meet the specific demands and problems of their future jobs.

Thus, studying IT in college provides a comprehensive approach that covers both the fundamentals and practical applications of information technology, preparing students for success in their professional lives. For example, the discipline "Information Technologies in Economics" and its synonymous "Information Technologies in Management" are included in the educational programme of training the students of economic specialities. A modern economist should be able to make informed decisions based on information flows. In addition to traditional economic knowledge, a student should be familiar with the process of data processing and possess the skills to build information systems (Dedeneva & Aksyukhin, 2016; Daceva, 2019; Labuz & Mazaeva, 2016; Tenischeva et al., 2019).

5. Research Methods

In this regard, it is possible to formulate the main pedagogical goals of using information technology in teaching:

i. Development of self-consciousness and value self-determination of personality on the basis of the mastering by students of the system of knowledge, skills and abilities, formation of world outlook adequate to the modern information society.
ii. Adaptation of training to individual capabilities, needs and interests of the student on the basis of development of the learner's personality, preparation for independent productive activity in the conditions of modern information society.
iii. Development of personal potential, creative thinking and creative abilities, and communication skills of students (Kondratiev, Boran-Keshishyan, et al., 2019).

6. Findings

Means of information technologies play a special role in the development of students' self-educational activity skills, as they allow ensuring the optimal sequence and speed of perception of the proposed material for each student. There is the possibility of independent organisation of alternation of theory study, analysis of examples, methods of solving typical problems, development of skills of solving typical problems. There is also the possibility of self-control of the quality of acquired knowledge and skills to impart skills of analytical and research activity, to use the following methods of solving typical problems.

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7. Conclusion

Informatisation of education should be ahead of informatisation of other spheres of social life, as social, psychological, general cultural and professional prerequisites for informatisation of the whole society are laid in this sphere (Kondratiev, Khekert, et al., 2019). In this regard, the problem of expanding the use of information technologies in the modern educational process is of particular relevance.

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