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Information and Communication Technologies in Modern Education and their Application in the Teaching Process

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Abstract: This article highlights the role and significance of information and communication technologies (ICT) in the modern educational process. It analyzes opportunities such as improving the quality of education through ICT, organizing the learning process effectively, and increasing student engagement. Additionally, methods of using Learning Management System (LMS) platforms, web technologies, and cloud services in the learning process are discussed. Special emphasis is placed on the widespread application of Google's cloud services - Google Classroom, Drive, Docs, and Meet - in education. The article aims to enhance the efficiency of teaching by applying technological approaches to modern teaching methods.

Keywords: Information and Communication Technologies (ICT), digital education, technological approach, interactive lesson, distance learning, electronic educational resources, virtual classroom, online education platforms, multimedia tools, digitization in education, automation of the learning process, digital pedagogy

Introduction

The 21st century has become the era of informatization and communication. Naturally, questions arise in society regarding what informatization is, what its functions are, and what its main features include. Because it is difficult to imagine human activity without information. In daily life, various forms of information—such as text, graphics, tables, audio (voice), images, video, and others—are constantly processed. Working with each type of information (collecting, storing, etc.) requires information devices with different technical specifications.

Today, ICT (Information and Communication Technologies) are widely used in all spheres of life, including the education system. These technologies focus on organizing the learning process efficiently, shaping modern knowledge and skills among students, individualizing education, and computerizing distance learning. Using modern teaching technologies in lessons yields significant positive results.

The automation (informatization) of teaching or the use of information technologies can include the following:

Ensuring ICT leadership at all levels of the education system;

Planning and creating projects for the development of informatization across all fields (monitoring);

Creating regulatory frameworks in ICT areas (scientific-methodological associations, etc.);

Technical support—including computers, other ICT devices, and creating materials necessary for servicing them;

Telecommunication networks;

Supply resources (software, online information collections, databases, etc.).

The use of ICT and its application to specific sectors involve a range of tasks. Below, we discuss objects of informatized activity, which include: numbers (measurement and modeling results), texts, statistical and dynamic representations of visual

information, images, diagrams, animations, audio images (recorded speech, music), and others.

Activities undertaken independently and consciously by users involve creating information objects, searching for necessary information objects, collecting, analyzing, and filtering data, organizing, representing in necessary formats, transmitting, modeling, designing, planning objects, and more.

Information technology models are assimilated into conscious and intentional execution of certain operations. This process includes:

Computers, printers, modems, microphones, audio devices, scanners, digital video cameras, multimedia projectors, drawing tablets, musical keyboards, and their software support;

Software programs;

Virtual text constructors, animations, music, physical models, geographic maps, etc.;

Information collections—databases, encyclopedias, virtual museums, etc.;

Technical skills simulators (e.g., data entry from buttons, initial mastery of software tools, etc.).

Analysis of computer-based teaching programs in leading foreign countries and our republic's top educational institutions shows that these are new teaching tools significantly different from traditional methods. One of the main tools of this approach is modeling theory using computers.

In the process of teaching based on multimedia tools, full digital instruction of specific subjects, editing lecture texts, improving the presentation of control results submitted by students, visualizing animations for processes related to each topic, and enabling students to see, hear, and reflect on multimedia elements are all possible.

Teachers working with multimedia ICT tools should perform the following tasks:

Prepare lecture texts and practical assignments;

Create methodological guidelines, control questions, and correct answer options;

Develop work programs and technological maps;

Analyze the results of knowledge control;

Edit lecture texts;

Visualize animations reflecting dynamic processes for each topic;

Organize consultations with students on theoretical and practical questions for independent work;

Conduct discussions on topics that are difficult to master.

Following these requirements, organizing lessons using multimedia ICT tools simplifies the work of pedagogical teachers, improves classroom management, and enhances overall effectiveness.

Additionally, educational institution management can review students' acquired knowledge, test results, and assess their mastery level, evaluate the quality of teachers' presentation materials and independent works, develop animated presentations modeled on computers for laboratory work, and create methodological materials for course mastery. This allows for the implementation of various proposals for improving the organization of the learning process.

The use of the computer - informatization model depends on the characteristics of the subject being taught and allows presenting the internal and external features of objects to be demonstrated during lessons. This, in turn, shows the possibility of

creating multimedia electronic textbooks based on information-pedagogical technologies.

The multimedia tools of ICT are especially significant in the learning process due to the following main aspects:

Organization of differentiated and individualized learning;

Evaluation of the learning process and feedback;

Self-control and correction;

Demonstration of studied subjects and visualization of their dynamic processes;

Use of animation, graphics, cartoons, sound, and other computer and ICT technologies in lesson topics;

Acquisition of essential skills for students to master the subjects.

Furthermore, the practical aspects of multimedia tools, their use during lessons, and the future development of information bases and animated presentations for educational purposes lay a foundation for enhancing the learning process.

It is known that each educational institution strives to create its virtual information learning environment based on modern technologies to manage the educational process effectively. Today, the need to create a virtual information learning environment has diminished because various software packages compatible with the Web environment, developed in collaboration with dedicated programmers and industry specialists, as well as supported by educational funds, have been created as open-source and freely available.

This analysis presents the potential of open-source and free software packages that enable organization of distance learning. The software packages listed in the module are the result of many years of scientific research. Distance education is a form of education based on information and telecommunication technologies, encompassing both traditional and innovative methods, employing various educational tools and formats, including remote and face-to-face learning.

Distance Learning is an educational system based on new information technologies, telecommunication technologies, and technical tools. It is a system that ensures learners have access to educational conditions and communication with instructors based on established standards and educational laws, while requiring the learner to be more independent in their learning process. In this system, the learning process is not dependent on the learner's location or time.

Remote Education is a form of education that relies on exchanging educational information remotely, facilitated by specialized ICT environments, providing educational services to all segments of the population and foreign students. The remote learning system is organized based on conditions for distance education. Like all educational systems, it has its own objectives, content, methods, tools, and organizational forms.

The application of ICT in the educational process - especially in remote learning - is generally carried out in two main forms: the first involves the use of technical equipment, and the second involves the use of specialized software.

Technical Equipment includes computers, network devices, high-speed internet connections, video conferencing equipment, and similar tools.

Software encompasses programs used with existing devices and a set of applications designed specifically for this field.

The technical equipment includes:

Computers, printers, modems, microphones, audio devices, scanners, digital video cameras, multimedia projectors, drawing tablets, musical keyboards, and their software support.

Software applications include:

Programs for operation and management of devices.

Virtual text constructors, animations, music, physical models, geographic maps, and others.

Information collections such as encyclopedias, virtual museums, and reference materials.

Technical skills simulators (e.g., data entry from buttons, initial mastery of software tools, etc.).

Analysis of computer-based teaching programs in leading foreign countries and top educational institutions in our country indicates that these are new teaching tools that differ fundamentally from traditional methods. One of the main approaches of this methodology is the theory of computer modeling.

In the process of teaching with multimedia tools, it is possible to fully teach specific subjects using computers, edit lecture texts, improve the presentation of exam results submitted by students, visualize processes through animations for each topic, and enable students to see, hear, and analyze multimedia elements during lessons.

Teachers working with multimedia ICT tools should perform the following tasks:

Prepare lecture texts and practical assignments;

Create methodological guidelines, control questions, and correct answer options;

Develop work programs and technological maps;

Analyze the results of knowledge assessments;

Edit lecture texts;

Visualize animations depicting dynamic processes related to each topic;

Organize consultations for students on theoretical and practical questions for independent work;

Conduct discussions on complex topics with students.

By meeting these requirements, organizing lessons with multimedia ICT tools simplifies teachers' work activities, improves classroom management, and enhances the overall effectiveness of the learning process.

Alongside this, educational institutions can review students' acquired knowledge and test results, evaluate the quality of materials prepared by teachers for lectures and independent works, develop animated presentations modeled on computers for laboratory work, and create methodological materials for course mastery—thus expanding the possibilities for effective teaching.

The use of the computer - informatization model depends on the characteristics of the subject being taught and provides the ability to demonstrate the internal and external features of objects during the lesson. This, in turn, indicates that multimedia electronic textbooks based on informational and pedagogical technologies can be created.

The multimedia tools of ICT are particularly important in the learning process due to the following key aspects:

Organization of differentiated and individualized teaching;

Assessment of the learning process and feedback;

Self-monitoring and correction;

Presentation of studied subjects and visualization of their dynamic processes;

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Use of animations, graphics, cartoons, sounds, and other computer and ICT technologies in topics;

Helping students acquire essential skills for mastering the subject matter.

Additionally, the practical aspects of multimedia tools—such as their use in the learning process and their role in creating information bases and animated presentations—lay the foundation for further improving the educational process.

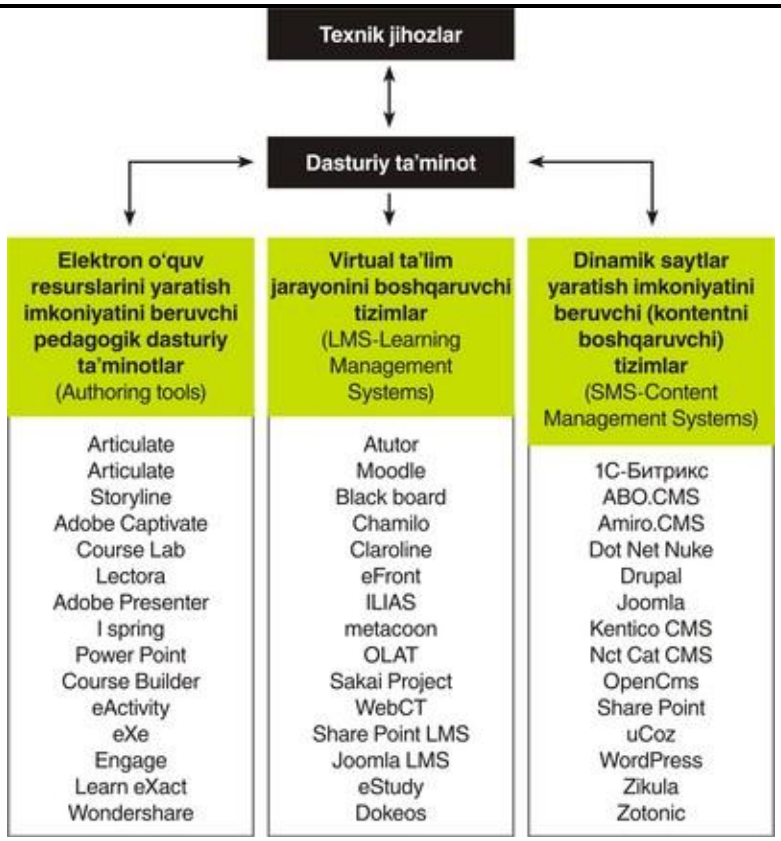
It is well known that each educational institution strives to develop its virtual information learning environment based on modern technologies. Today, the need for creating a virtual ICT-based learning environment has diminished, as various software packages compatible with the Web environment, developed through collaboration between dedicated programmers and education professionals, supported by educational funds, and available as open-source software, have been created.

This analysis presents the opportunities offered by open-source and free software packages for organizing remote learning. The software packages listed in this module are the results of many years of scientific research.

Remote Learning is a form of education based on the best traditional and innovative methods, employing various educational tools and formats, including both extramural and face-to-face education, all rooted in information and telecommunication technologies.

Distance Education is an educational system based on new ICT, telecommunication technologies, and technical tools. It provides learners with educational conditions and communication with teachers based on established standards and laws, while demanding greater independence from the learner. The learning process is independent of where and when the learner is.

It relies on exchanging educational information remotely, with teachers utilizing specialized ICT environments to provide educational services to all layers of the population, including foreign students. The distance learning system is organized based on conditions for remote education.



Learning Management Systems

LMS (Learning Management Systems) are specialized software platforms that enable the creation, distribution, assessment, and management of educational materials. Some popular LMS systems include:

Moodle – An open-source, user-friendly platform for educators and educational institutions.

Google Classroom – A simple and efficient LMS integrated with the Google ecosystem.

Edmodo, Canvas, Blackboard – Other well-known educational platforms. Through these systems, students can receive class assignments, submit tasks, and view results online.

Web technologies refer to tools based on the internet, which are used in education in the following ways:

Online classes and video tutorials

Quizzes and tests

Communication via forums and chats

Working with electronic books and articles

Web technologies allow students to quickly access information and learn independently. Additionally, they enable teachers to create and distribute new educational resources.

Infrastructure as a Service (IaaS) involves a set of physical resources such as servers, network equipment, and storage devices, provided as services to the user. Infrastructure services address the needs of data processing centers by offering computational power as necessary, ensuring proper and efficient equipment of data processing facilities.

Advantages:

Reduces capital investments in technical infrastructure.
Typically, virtualization techniques used in this model enable more efficient resource utilization, leading to cost savings.
Decreases the risk of investment loss and shortens deployment time.
Supports automatic scalability.

Disadvantages:

Business efficiency and labor productivity depend on the provider's capabilities.
Long-term operational costs may be high.
Centralization requires new approaches to security.
Examples of infrastructure services include **IBM SmartCloud Enterprise, VMware, Amazon EC2, Windows Azure, Google Cloud Storage, and Parallels Cloud Server**.

Cloud technologies are modern solutions that allow data to be stored and accessed via the internet. In education, cloud technologies are used for:
Remote document management
Collaborative work on shared platforms
Secure data storage and access from any device

Google Cloud services offer a convenient ecosystem for education, including:
Google Drive – Storage and sharing of documents, images, videos
Google Docs, Sheets, Slides – Creating and editing online documents
Google Classroom – A Learning Management System for organizing lessons, assigning tasks, and grading
Google Meet – For remote video conferencing and meetings

These Google services facilitate collaboration and data sharing between teachers and students.

Conclusion: The integration of ICT, LMS, Web, and cloud technologies into the educational process plays a vital role in creating a modern learning environment. These technologies make education more effective, engaging, and inclusive. Particularly, tools like Google's cloud services simplify knowledge acquisition and expand learning opportunities.

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