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EDUCATIONAL TECHNOLOGIES AND METHODS OF TEACHING COMPUTER SCIENCE COURSE

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ABOUT ARTICLE

Key words: Innovative technology, methods and forms of innovative technologies, teaching technology, educational process, educational technologies, effectiveness of using innovative technologies in teaching computer science.

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Abstract: The modern period of development of society is characterized by a strong influence on it of information technologies, which penetrate into all spheres of human activity and form a global information space. Information technologies are intended to become not an additional tool in learning, but an integral part of the holistic educational process, significantly increasing its effectiveness. The main ideas are placed on the creation and maintenance of information and educational learning environments, on the development of new object technologies for creating databases of educational materials, along with the development of traditional technologies and methods of teaching computer science courses. The article discusses the main methods of innovative technologies and their use in teaching computer science to students. The functions of innovative teaching and the most characteristic aspects of innovative technologies used in computer science lessons are analyzed. The advantages of using innovative methods in teaching activities have been studied and highlighted. The article explains how to organize training with innovative technologies for the effective organization of the educational process, allowing students to take an active position and express themselves as subjects of educational activities.

INFORMATIKA FANINI O‘QITISHNING TA’LIM TEXNOLOGIYALARI VA METODLARI

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MAQOLA HAQIDA

Kalit so‘zlar: innovatsion texnologiya, innovatsion texnologiyalarning metod va shakllari, o‘qitish texnologiyasi, ta’lim jarayoni, ta’lim texnologiyalari, informatika fanini o‘qitishda innovatsion texnologiyalardan foydalanish samaradorligi.

Annotatsiya: Jamiyat taraqqiyotining zamonaviy bosqichi unga axborot texnologiyalarining kuchli ta’siri bilan tavsiflanadi. Ular inson faoliyatining barcha sohalariga kirib borib, global axborot makonini shakllantirmoqda. Axborot texnologiyalari ta’lim jarayonida qo‘shimcha vosita emas, balki uning ajralmas qismiga aylanishi, ta’lim samaradorligini sezilarli darajada oshirishi lozim.

Asosiy e’tibor axborot-ta’lim muhitlarini yaratish va qo‘llab-quvvatlashga, o‘quv materiallari bazalarini yaratishning yangi obyektga yo‘naltirilgan texnologiyalarini ishlab chiqishga qaratilgan bo‘lib, bu jarayon informatika fanini o‘qitishning an’anaviy texnologiya va metodlarini rivojlantirish bilan birga olib boriladi.

Maqolada innovatsion texnologiyalarning asosiy metodlari va ularning talabalarni informatika faniga o‘qitishda qo‘llanilishi ko‘rib chiqilgan. Innovatsion ta’limning funksiyalari hamda informatika darslarida qo‘llaniladigan innovatsion texnologiyalarning eng muhim jihatlari tahlil qilingan.

Ta’lim faoliyatida innovatsion metodlardan foydalanishning afzalliklari o‘rganilib, yoritib berilgan. Shuningdek, maqolada ta’lim jarayonini samarali tashkil etish uchun innovatsion texnologiyalar asosida o‘qitishni tashkil etish yo‘llari tushuntirilgan bo‘lib, bu talabalar faol pozitsiyani egallashi va o‘zini ta’lim faoliyatining subyekti sifatida namoyon etishiga imkon beradi.

ОБРАЗОВАТЕЛЬНЫЕ ТЕХНОЛОГИИ И МЕТОДЫ ПРЕПОДАВАНИЯ ИНФОРМАТИКИ

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О СТАТЬЕ

Ключевые слова: инновационные технологии, методы и формы инновационных технологий, технология обучения, образовательный процесс, образовательные технологии, эффективность использования инновационных технологий при обучении информатике.

Аннотация: Современный этап развития общества характеризуется сильным влиянием на него информационных технологий, которые проникают во все сферы человеческой деятельности и формируют глобальное информационное пространство. Информационные технологии должны стать не дополнительным средством обучения, а неотъемлемой частью целостного образовательного процесса, значительно повышающей его эффективность.

Основное внимание уделяется созданию и поддержке информационно-образовательной среды, разработке новых объектных технологий создания баз данных учебных материалов наряду с развитием традиционных технологий и методов преподавания информатики.

В статье рассматриваются основные методы инновационных технологий и их применение при обучении студентов информатике. Проанализированы функции инновационного обучения и наиболее характерные аспекты инновационных технологий, используемых на уроках информатики.

Изучены и выделены преимущества использования инновационных методов в учебной деятельности. В статье также объясняется, как организовать обучение с использованием инновационных технологий для эффективной организации образовательного процесса, что позволяет студентам занимать активную позицию и проявлять себя как субъекты образовательной деятельности.

Instructions. The introduction of new educational technologies in the classroom, in particular the academic subject “Informatics,” leads to the constant updating and modernization of the necessary knowledge, skills and abilities. It is required to develop information competence, intellectual abilities,

and critical thinking at a level suitable for solving real practical problems in computer science classes. The relevance of using modern pedagogical technologies lies in the fact that in the modern socio-economic environment the level of education largely depends on the effectiveness of the implementation of these teaching technologies, which is based on various principles that develop an active approach to education.

The introduction of modern pedagogical technologies is a purposeful, systematic and consistent introduction into practice of original, innovative methods, methods of pedagogical actions and means, covering the entire educational process from defining its goal to the expected results. The problem of the widespread use of information technologies in the field of education in the last decade has attracted increased interest in domestic pedagogical science.

People have been talking about innovations in the educational system since the 80s of the 20th century. It was at this time that the problem of innovation and, accordingly, its conceptual support arises in pedagogy. This has become the subject of special research. The terms “innovations in education” and “pedagogical innovations,” used as synonyms, were scientifically substantiated and introduced into the categorical apparatus of pedagogy.

Pedagogical innovation is the introduction of something new into pedagogical activity, changes in the goals, content, methods and forms of teaching and upbringing, the purpose of which is to increase the effectiveness of the joint activities of the teacher and the student [2].

The most prominent Russian and foreign academic scientists A.I. Berg, A.P. Ershov, N.Kolmogorov, P. Landa, S. A. Lebedev, N. Wiener, D. Neumann, S. Papert, K. Shannon and others.

Scientists made a great contribution to the study of the processes of informatization of education and solving the problem of computer teaching technologies: Y.A. Vagramenko, E.P. Velikhov, G.R. Gromov, V.I. Gritsenko, B.S. Gershunsky, D.V. Zaretsky, A. Abdukadyrov, N. Tailakov, F. Zakirova and others.

So, information technology and education together become those areas of human interests and activities that mark the era of the 21st century and should become the basis for solving the problems facing humanity.

Materials and Methods. Innovation in the broad sense of the word refers to the use of innovations in the form of new technologies, types of products and services, organizational, technical and socio-economic solutions of a production, financial, commercial, administrative or other nature. The innovation process is associated with the creation, development and dissemination of innovations.

Innovative technologies in education are represented as a complex of three elements:

1.Content that is conveyed to students. It is aimed at developing competencies adequate to the modern world. This content must be well structured, clearly presented in the form of multimedia and transmitted through modern communications.

2.A teaching method that should be aimed at actively involving students. Knowledge should not be acquired passively, but with the direct participation of children.

1.3.Training tools, including informational, technological, organizational and communication components.

The main goals of modern educational technologies include:

– formation of fundamental knowledge in students, which will allow them to further acquire new knowledge, work and retrain;

– formation of a creative personality type, abilities for group and analytical work, tolerance, development of project thinking.

Currently, with the introduction of new innovative technologies, the organization of educational activities has changed and the need to intensify the student's cognitive activity has increased. The introduction of new innovative technologies into lessons makes it possible to effectively organize the educational process, providing students with new methods, means and sources of obtaining educational material [1].

Effective forms of educational work for the introduction of innovative processes into the educational process and the formation of key professional competencies of future specialists is the use of various active forms and methods of teaching. This is problematic and gaming technologies, technologies of collective and group activities, simulation methods of active learning, methods of analyzing specific situations, project method, preparation of public speeches, discussion of professionally important problems, collaborative learning, creation of problem situations, lecture-conversation, lecture-dispute, etc.

In the process of studying computer science using innovative technologies, the computer acts not only as a source of information, but also as a learning tool and a powerful tool that allows you to activate the process of cognitive activity, promoting the development of flexibility of thinking and the formation of the ability to navigate and adapt in your activities. Therefore, a computer science teacher should set a goal - to provide positive motivation for learning, to intensify the cognitive activity of students, and to achieve this goal, in addition to mastering knowledge, mastering techniques with which one can obtain, process and use new information becomes equally important. At the moment, in the teaching of computer science, modern innovative technologies are used to develop the cognitive and creative activity of students, which improve the quality of education, effectively use study time and reduce part of the reproductive activity of students by reducing time.

The leading functions of innovative training can be considered:

– intensive development of the personality of the student and teacher;

– democratization of their joint activities and communication;

– humanization of the educational process;

– focus on creative teaching and active learning and student initiative in shaping oneself as a future professional;

– modernization of means, methods, technologies and material base of training that contribute to the formation of innovative thinking of the future professional.

The methodology for using innovative technologies in the study of computer science involves:

– improving the learning management system at various stages of training; strengthening motivation for learning;

– improving the quality of teaching and education, which will increase the information culture of students;

– increasing the level of personnel training in the field of modern information technologies;

– mastering the ability to work with various types of information using a computer and other means of information technology, organizing one's own information activities and planning its results;

– development of cognitive interests, intellectual and creative abilities by means of information technology;

– demonstration of the capabilities of modern information technology tools in the educational process.

One of the methods of active teaching of computer science using innovative technologies is problem-based learning, project method, interactive technologies, business games, integrated lessons, etc.

In a business game, several players interact, making decisions in a situation that simulates a real one, and the teacher directs the game, analyzes and evaluates the actions of the players. Each of the participants plays a certain role, he makes decisions and can quickly see the result, thus gaining his own experience. Business games in the study of computer science provide directed activity of students' mental processes: they stimulate thinking when using problem situations, ensure that the main thing is remembered in class, arouse interest in the discipline being studied and develop the need for independent acquisition of knowledge.

To increase the motivation of the educational process, using the project method is one of the most successful ways to teach computer science. When studying computer science, students complete various projects, such as creating crossword puzzles, cartoons, educational and educational games, etc.

The project method involves the use of a wide range of problem-solving, research, and search methods focused on real results that are significant for the student. This approach to teaching allows you to turn practical and seminar classes into a discussion and research club in which truly interesting, practically significant problems are solved.

The implementation of the method project method in practice leads to a change in the position of the teacher. From a carrier of ready-made knowledge, he turns into an organizer of cognitive, research activities of his students. The psychological climate in the group also changes, as the teacher has to reorient his teaching and educational work and the work of students towards various types of independent activities of students, to the priority of activities of a research, search, and creative nature.

When applying the project method to solve various problems using a computer, 6 main stages can be distinguished, which are presented in Table 1.

Table 1. Stages of project implementation

Stage	Task	Activities of students	Activities of teachers
1	**2**	**3**	**4**
Start execution	Defining a topic, clarifying goals, choosing a working group	Clarify information, discuss the task	Motivates students, explains project goals, observes
Planning	Analysis of the problem, identification of sources of information, setting tasks and selection of criteria for evaluating results, distribution of roles in the team	They formulate tasks, clarify information (sources), select and justify their success criteria	Assists in analysis and synthesis, observes
Decision-making	Collection and clarification of information, discussion of alternatives (brainstorming), selection of the optimal option, clarification of activity plans	Work with information, synthesize and analyze ideas, perform research	Observes, advises
Performance	Project implementation	Carry out research and work on the project, draw up the project	Observes, advises
Grade results	Analysis of project implementation, achieved results (successes and failures) and the reasons for this, analysis of achievement of the set goal	Participate in collective project introspection and self-evaluation	Observes and directs the analysis process (if necessary)
Protection project	Preparation of a report, justification of the process, design, explanation of the results obtained, collective defense of the project, evaluation	Defend the project, participate in a collective assessment of the project results	Participates in collective analysis and evaluation of project results

Nowadays, in the age of information technology, it is simply necessary to use a new teaching method, such as multimedia. The very concept of “multimedia” is a polysemantic term. In a narrow sense, the term refers to computer hardware (sound and video equipment that allows you to reproduce audio and video information of any format) [4].

In a broad sense, “multimedia” means a whole range of information technologies that use a variety of software and hardware to effectively influence the user [2].

Multimedia products contain simultaneously graphic, audio and visual information, which allows you to work with information of various types (for example, sound, hypertext, photo, video), therefore expanding the field of activity of the teacher.

Multimedia presentations in teaching computer science provide: intensification of learning, student activity, individualization of learning, development of independence, increased motivation, etc.

In this connection, active learning methods are of particular interest, because they contribute:

– effective knowledge acquisition;

– develop practical research skills that allow you to make professional decisions;

– allow you to solve the problem of transition from simple accumulation of knowledge to the creation of mechanisms for independent search and research skills;

– form value orientations of the individual;

– increase cognitive activity;

– develop creative abilities;

– create didactic and psychological conditions that promote student activity.

Traditionally, modern multimedia includes a computer. The versatility of a computer lies in the fact that, together with an appropriate set of peripheral devices (projector, modem, printer), it is able to provide all the functions of multimedia educational tools.

The main goals of computer training are:

– formation of skills to work with information, development of communication abilities;

– preparation of the personality of the “information society”;

– formation of research skills;

– formation of skills to make optimal decisions;

– present as much information as the specialist is able to absorb.

The conceptual features of the application of such training are:

– the principle of adaptability: adapting the computer to the individual characteristics of each participant;

– controllability: correction of the learning process is possible at any time;

– unlimited learning: the content, its interpretation and applications can be as large as desired;

– maintaining the student’s psychological comfort when communicating with a computer;

– interaction of a specialist with a computer can be carried out in all types: subject – subject, subject – object, object – subject [5].

Training carried out using computer telecommunications has the following forms of classes:

– chat classes – training sessions carried out using chat technologies. Chat classes are conducted synchronously, that is, all participants have access to the chat at the same time;

– web classes – distance lessons, conferences, seminars, business games, laboratory work, workshops and other forms of training sessions conducted using telecommunications.

For web classes, specialized educational web forums are used - a form of user work on a specific topic or problem using entries left on one of the sites with the corresponding program installed on it.

Working online stimulates students' cognitive interest. A new world of a foreign language opens up for them, when knowledge of one meaning of a word is no longer enough to understand a text or article.

– teleconferences – are usually held on the basis of mailing lists using e-mail.

With the introduction of modern technologies in training, it becomes possible to organize a dialogue with each specialist, study the material at an individual pace, and effectively organize control.

Telecommunications are adding a new dimension to distance learning and are developing very rapidly in the form of asynchronous email applications. The analysis made it possible to identify the basic parameters that are essential when choosing information technologies for use in interactive learning programs in universities.

The computer guarantees confidentiality. The student knows what mistakes he makes, he has no fear that someone will find out about his mistakes. The computer also has great methodological advantages. It instantly reacts to the entered information, i.e. The computer provides a greater degree of interactive learning than classroom work. This is ensured by constant and direct response to the participants' answers during the practical tasks. And since participants determine their own pace of work, computer-based learning fits perfectly with the principle of individual learning [12].

The computer can be used at all stages of the learning process: when explaining new material, consolidating, repeating, monitoring knowledge, skills and abilities [3].

Table 1. Comparative characteristics of educational technologies

Technology	Characteristics
Audiovisual media (printed materials, audio, video, cassettes)	Low communication interactivity. The cost of production depends linearly on the number of trainees. Method for developing educational materials are well known. High durability
Computer-assisted learning asynchronous email	Average degree of interactivity. The most developed infrastructure on education. Low cost
Video conferences over the Internet computer network in real time	High degree of interactivity. The most developed network infrastructure in the world. Use of widely used computer platforms. Low cost

The Internet increases the role of “network” teachers, because their zone of influence with the help of telecommunications increases hundreds and thousands of times compared to the usual educational process. A talented teacher is interesting not only to those people who surround him; his

mission is broader - to help those who want to learn from him, using distance technologies for this. In our century, the best teachers are likely to be distance teachers, that is, those who have the opportunity and know how to interact with the whole world using electronic telecommunications.

Classes using interactive technologies, including multimedia presentations, allow students to visually assimilate educational material.

Modern education provides for a significant expansion of the role of information technology as an effective means of self-development, self-improvement and self-education of students. The ability to find and collect information and check its reliability is the first step towards independent work with information sources. The use of innovative technologies can create such psychological conditions in which the student takes an active position and manifests himself as a subject of educational activity. Innovative technologies in education help improve the quality of learning. To improve the educational activities of students using innovative technologies, knowledge about modern information technologies, the ability to use information resources, and the ability to work independently using computer technology are required. The introduction of innovative technologies into the educational environment increases the efficiency of educational activities by automating information processing and calculations. Innovative technologies have an integrating property in relation to all other technologies; new technologies, methods and methods of teaching are developed so that the student can achieve success in life, using all their capabilities. In connection with the development of information and communication technologies and scientific and technological progress, more attention has now been paid to the problems of teaching computer science. A modern computer science teacher needs not only the presentation of interesting activities, but also powerful tools for creating such activities, as well as tools for monitoring student knowledge, tracking progress and problem areas in learning.

Results. One of the directions for increasing the level of assimilation of educational information is the introduction of interactive teaching methods. Today, interactive methods are not used enough in educational institutions.

“Interactive methods” are understood as methods characterized by a two-way exchange of information between students and the teacher, and promoting more active and creative work of students, revealing their potential [3].

Unlike active methods, interactive ones are focused on broader interaction between students not only with the teacher, but also with each other. The teacher’s place in interactive classes comes down to directing the students’ activities to achieve the goals of the lesson.

As pedagogical experience shows, the most commonly used interactive methods in teaching computer science are: project method, work in small groups, heuristic conversation, discussion,

brainstorming, business game, role-playing game, sinkwine or slow immersion, microphone, practical work competitions with their discussion, etc.

Table 2 presents interactive teaching methods that can be used when conducting computer science classes for 1st year students in the field of “Mathematics and Computer Science”.

Table 2. Interactive methods of teaching computer science

Lesson topic	Teaching methods
Introduction to the basics of computer science. History and stages of development of computers. Computer support: hardware and software	Sinkwine microphone
The concept of information, types, properties, and units of measurements of information. Number system and information coding.	Brainstorm
Modern computers types and architecture of computers. Basic and peripheral devices of a computer and their purposes.	Microphone
Computer software. Modern document processing technologies. Text editors-MS Word	Brainstorm
Computer graphics and its types. Basic of working with Power Point	Business game
Spreadsheets tasks and capabilities of a spreadsheet. Examples for a spreadsheets	Sinkwine
About information protection computer viruses and ant-viruses programs. Archiving and archivers	Brainstorm
Concept of date, database and database management systems. Database programs.	Visualization method
Basics of algorithmization. Stages of solving problem in computers. Model ans simulation. The concept of an algorithm and its properties. Types of algorithms	Business game, Microphone
Branching algorithms. Cyclic algorithms. Iterative algorithms. Mixed (combined) algorithms	Project method
Scratch software shell	Project method
Basics of programming. Python programming language and its capabilities. Iinear, branching and repeating processes	Visualization method
Creating and using function in the Python programming language. Arrays and graphics in the Python programming language	Brainstorm
Internet Basics and concepts. Internet search engines. Email and it services. Cloud technology.	Microphone
Distance learning (education). Types and functions of DO. Introduction to the platforms Coursera, Khan Academy, Lektorium, EdX, Udemy	Visualization method
Working with audio and video files	Project method
GIF- animation	Visualization method
Coding and processing of audio information	Microphone
HTML technology. Development of Web sites	Project method
3D modeling	Project method

The materials for the experimental work, which was carried out during the 2022-2023 academic year, were discussed with the experimenting teachers, in addition, the teachers received detailed advice and a technological map of classes compiled for them by the author of the study. At the same time, the conditions necessary for the introduction of innovative teaching methods and techniques in the teaching of computer science were identified and described.

Using a specially compiled questionnaire, the level of teaching competencies acquired by experimental teachers was studied, and the degree of readiness to implement innovative methods and techniques in teaching activities was revealed.

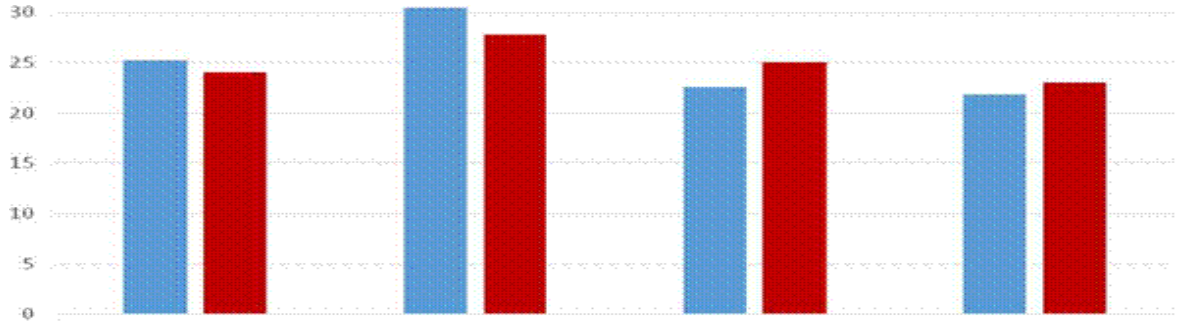
Statistical analysis of the results of the training experiment showed that the dynamics of the formation of innovative competencies of students in experimental groups, subject to the introduction of innovative technology using various methods and techniques of interactive learning, has pronounced quantitative indicators (see Table 3).

Table 3. Results of the experimental work

Quantitative indicators	Results in the experimental group (EG)		Results in the control group (CG)	
	students	In %	students	In %
Total students	115	100	108	100
Completed great	35	30,4	26	204
Completed fine	32	25,2	30	27,8
Completed satisfactory	26	22,6	27	25
Completed unsatisfactory	25	21,8	25	23,2

Comparative results of the control stage of the experimental work in the experimental and control groups are presented in Diagram 1.

Diagram 1. Comparative results of experimental work in experimental and control groups (in%)



Discussion. To select a technology, it is necessary to rebuild the traditional stereotype of a teacher's activity: understand the student, accept the student, recognize the student as a subject of the learning process and select educational technologies, taking into account the selection of the training platoon and age, topic and selection of didactic material, not forgetting the desired results.

The most productive and optimal way to solve the educational, pedagogical and educational problems of computer science is the use of active teaching methods, which is why modern educational technologies are so relevant today, which are aimed at organizing the activities of students, at developing through this activity their skills, qualities, competencies for active use in modern information space. The teacher uses more activating teaching methods instead of translating abstract, "ready-made" information.

The forms of work should captivate students, awaken their interest and motivation, and teach them independent thinking and action.

Educational technologies provide ample opportunities for differentiation and individualization of educational activities. The result of using educational technologies depends to a lesser extent on the skill of the teacher; it is determined by the entire set of its components.

Conclusion. Thus, the organization of teaching computer science based on innovative technologies ensures a higher quality of student knowledge through clear planning of classes and increased motivation when studying the content of the subject. In the process of studying computer science, students develop the ability to work with information to complete the assigned task, master software at a higher level, learn to research, put forward their ideas, and analyze educational material.

Studying the experience of using educational technologies and methods in teaching computer science, one can highlight their advantages:

– they help teach students active ways to acquire new knowledge;

– provide an opportunity to master a higher level of personal social activity;

– create such learning conditions under which students cannot help but learn;

– stimulate the creative abilities of students;

– help to bring learning closer to the practice of everyday life, form not only knowledge, skills and abilities in the subject, but also an active life position.

Thus, if you use a variety of educational technologies and methods in teaching computer science, then students will have the necessary knowledge, skills, adaptive, thinking and communication abilities, as well as master the methods of working with information:

– collect the facts necessary to solve existing problems,

– analyze them, propose hypotheses for solving problems,

– summarize facts, compare solutions, establish statistical patterns, give reasons for your conclusions and apply them to solve new problems,

– apply modern means of obtaining, storing, converting information, etc.

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