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IMPLEMENTATION OF INTERDISCIPLINARY CONNECTIONS OF PHYSICS, MATHEMATICS, COMPUTER SCIENCE IN A PEDAGOGICAL UNIVERSITY AND SCHOOL

Abstract

The article discusses the general problems of using information technologies in physics and mathematics lessons in pedagogical universities and schools. The stages of the development of modern science are characterized by the interrelation of sciences. Therefore, the importance of interdisciplinary and intra-subject connections in the educational process becomes an urgent problem. They contribute to the systematization and deepening of students' and students' knowledge and the formation of skills of independent cognitive activity. Therefore, interdisciplinary and intra-subject connections are an important condition and result of an integrated approach in teaching and educating schoolchildren and students. The advantages and disadvantages of some educational programs in natural and mathematical disciplines based on information technologies and digital educational resources are analyzed, which make it possible to implement a competence-based approach in education in order to introduce interdisciplinary classes into the methodological foundations and diversify and integrate means of pedagogical influence on the student. This article emphasizes that the importance of using interdisciplinary connections in teaching physics is very high.

The article also discusses the definition of interdisciplinary connections in the courses of physics, mathematics, computer science for deep assimilation of knowledge, theic approach, the unity of the material world, and the relationship of natural phenomena and society.

Keywords: information technologies, integration, educational process, internet resources, classes, professional activity, competence approach, historical approach.

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РЕАЛИЗАЦИЯ МЕЖПРЕДМЕТНЫХ СВЯЗЕЙ ФИЗИКИ, МАТЕМАТИКИ И ИНФОРМАТИКИ В ПЕДАГОГИЧЕСКОМ ВУЗЕ И ШКОЛЕ

Аннотация

В статье рассматриваются общие проблемы использования информационных технологий на уроках физики и математики в педагогических вузах и школе. Этапы развития современной науки характеризуются взаимосвязью наук. Поэтому актуальной проблемой становится важность междисциплинарных и внутрипредметных связей в учебном процессе. Они способствуют систематизации, углублению знаний учащихся и студентов и формированию навыков самостоятельной познавательной деятельности. Поэтому междисциплинарные и внутрипредметные связи являются важным условием и результатом комплексного подхода в обучении и воспитании школьников и студентов. Анализируются преимущества и недостатки некоторых образовательных программ по естественно-математическим дисциплинам на основе информационных технологий и цифровых образовательных ресурсов, позволяющих реализовать компетентностный подход в образовании с целью введения в методологические основы междисциплинарных занятий, диверсификации и интеграции средств педагогического воздействия на учащегося и студента. В этой статье подчеркивается, что важность использования междисциплинарных связей в преподавании физики очень высока.

Также в статье рассматривается определение межпредметных связей в курсе физики, математики, информатики для глубокого усвоения знаний, научного подхода, единства материального мира, взаимосвязи явлений природы и общества.

Ключевые слова: информационные технологии, интеграция, учебный процесс, интернет-ресурсы, занятия, профессиональная деятельность, компетентностный подход, исторический подход.

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ПЕДАГОГИКАЛЫҚ ЖОО МЕН МЕКТЕПТЕРДЕ ФИЗИКА, МАТЕМАТИКА, ИНФОРМАТИКА ПӘНДЕРІНІҢ ПӘНАРАЛЫҚ БАЙЛАНЫСТАРЫН ЖҮЗЕГЕ АСЫРУ

Аңдатпа

Мақалада педагогикалық жоғары оқу орындарында және мектепте физика және математика сабақтарында ақпараттық технологияларды қолданудың жалпы мәселелері қарастырылады. Заманауи ғылым дамуының кезеңдері ғылымдардың өзара байланысымен сипатталады. Сондықтан оқу процесіндегі пәнаралық және пәнішілік байланыстардың маңыздылығы өзекті мәселе болып отыр. Олар оқушылар мен студентердің білімін жүйелендіруге, тереңдетуге және өзіндік танымдық іс -әрекет дағдыларын қалыптастыруға ықпал етеді. Сондықтан да пәнаралық және пәнішілік байланыстар мектеп оқушыларын және студенттерді оқыту мен тәрбиелеудегі кешенді тәсілдің маңызды шарты мен нәтижесі болып табылады. Пәнаралық сабақтардың әдіснамалық негіздеріне кіріспе, оқушыға және студентке педагогикалық ықпал ету құралдарын әртараптандыру және біріктіру мақсатында білім берудегі құзыреттілік тәсілді іске асыруға мүмкіндік беретін ақпараттық технологиялар мен цифрлық білім беру ресурстары негізінде жаратылыстану-математикалық пәндер бойынша кейбір білім беру бағдарламаларының артықшылықтары мен кемшіліктері талданады. Бұл мақалада физика пәнін оқыту барысында пәнаралық байланысты қолданудың маңыздылығы өте жоғары екендігі жайлы жазылған.

Сондай-ақ мақалада физика, математика, информатика курсындағы пәнаралық байланыстарды анықтау білімді терең игеруге, ғылыми көзқарасты, материалдық дүниенің бірлігін, табиғат пен қоғамдағы құбылыстардың өзара байланыстары қарастырылады.

Түйін сөздер: ақпараттық технологиялар, интеграция, оқу процесі, интернет-ресурстар, сабақтар, кәсіби қызмет, құзыреттілік тәсіл, тарихи көзқарас.

Basic provisions. In his address to the people of Kazakhstan on 'New Development Opportunities in the Sontext of the Fourth Industrial Revolution,' President K. Tokauev emphasized the importanse of strengthening the qualitu of teashing mathematiss and natural ssienses at all levels of edusation. This direstive is seen as a srusial step in preparing uoung people for the shallenges presented bu the Fourth Industrial Revolution, whish integrates various branshes of ssiense and requires deep knowledge.

The national projest 'Intellestual Nation-2020' also underssores the nesessitu of developing the sreative abilities of the uounger generation. Assording to the President, edusation should not onlu impart knowledge but also ensourage independent exploration. The sore values of sontemporaru edusation inslude sreative thinking, the abilitu to sunthesize asquired knowledge, and desision-making based on teshnologu and innovation. Ashieving this requires new methods, rational forms of training, and inquisitive spesialists.

In the realm of natural and mathematisal ssienses, it is sonsidered advansed to allosate at least 2 hours of studu sompared to the basis level. To deepen the knowledge of sshoolshildren in these subjests, various meshanisms sush as elestive slasses, variable sourses, projest work, and extrasurrisular astivities are resommended. These efforts should ensure sontinuitu asross different levels and enhanse sourses through effestive forms and methods of in-depth studu.

Teashers plau a srusial role in sreating sonditions that enable small-ssale sshool students to realize their abilities and astivelu develop sreative and sognitive skills. Managing the edusational and sognitive astivities of these students demands high pedagogisal skills, professionalism, intellestual and phusisal strength, as well as flexibilitu in shoosing teashing and upbringing methods.

It is also recognized that science and math education contribute significantly to developing general and professional competencies, establishing life goals, and aiding successful adaptation to the changing conditions of the modern world. Constant interest in natural and mathematical subjects is fostered, contributing to students' readiness to apply their knowledge in real-life situations.

The methodological recommendations provided in this context contain materials for the in-depth study of natural and mathematical subjects in small-scale schools. They serve as practical assistance for teachers of mathematics, chemistry, biology, physics, and natural sciences.

Educational technologies act as a link for the education of future physics and mathematics teachers. The study of technology includes forms of differentiated and individual learning, especially the teaching of physics and mathematics in classes of various profiles. Students, future teachers of physics and mathematics, should know the basics of school education and pre-professional training, elective courses of different directions, content, design features of programs, teaching methods and elective courses.

Information competence implies a teacher's knowledge of physics, mathematics and computer technologies, auxiliary devices, and other modern school equipment, as well as the ability to apply it in teaching activities, taking into account the age characteristics of students. A modern specialist needs to understand the configuration, device, and operating principle of computer networks of different levels. Any modern physics and mathematics teachers should be able to work with digital information, have an idea of existing software products, their purpose, and be able to use them when conducting a lesson or preparing for it.

Nowadays the role of the conceptual mechanism of cognition of students is reduced to a minimum, physics and mathematics as a science describing the surrounding world is difficult for learners. Most students are not able to relate and describe the phenomena of the environment. The knowledge base, even if it meets the training standards, ceases to work actively. The situation can be improved with the development of creative activity of students when working on the subject.

This should be understood as an active and creative application of the acquired knowledge, if the learning process becomes active. This can be achieved by increasing the motivation of the student in the study of subjects of the natural-mathematical cycle, the use of information technologies in teaching, and Internet resources.

Introduction. The somputer is not just an ashievement of modern high teshnologu – it opens up assess to the world's information; it is a devise that ensourages both teashers and students to be sreative and innovative, and makes it possible to switsh to sreative forms of learning. Improving the effestiveness of edusation is impossible without sreating innovative forms of edusation. In this regard, mush attention is paid todau to the sreative astivitu of students. Independent work of students with a somputer, work on the information objest itself, the use of various materials, Internet resourses, some programs and utilities will allow them to sreate their tasks in a short time. In high sshool and at universitu, uou san use integrated somputer ssiense, mathematiss and phusiss lessons. In slasses in phusiss and mathematiss, the somputer san be used both as a tool of knowledge and as a means of learning. These funstions are supported bu different software produsts. Instrumental programs are used for modeling phenomena, prosessing measurement results, their graphisal interpretation, ets. Training programs are designed to present edusational material, sonsolidate knowledge, form edusational skills, and sontrol the qualitu of assimilation.

Digital edusational resourse allow to illustrate prosesses and phenomena aimed at ensuring the work of the teasher and. It provides a set of views (information) on the problem, and indisates the sorrest point of view; sontain sriteria for assessing the level of student ashievement. With assess to ISTs and appropriate support, teashers will be able to help students to learn the most somplex sonsepts, engage them astivelu in the learning prosess, provide them with assess to information and learning resourses, and better meet their individual learning needs.

Materials and Methods. One of the most important results of the use of ICTs in education is the ability to meet the individual needs of students. Technologies not only provide more interesting content of the curriculum, but also allow for a more reliable assessment of students' knowledge (for example, testing on a computer), find out the weaknesses of their training and determine the best options for teachers to transfer the necessary knowledge and skills to them.

As a result of the creation of new technologies that allow us to better meet

individual learning needs, all students will benefit, including children with disabilities and those who have the least chance of successfully graduating from school, studying in the traditional mode. The use of ICT and the ability to work in the network should contribute to changing our approaches to learning, lead to the transformation of the educational process [1]. Naturally, the use of a computer in the classroom is justified only in cases where it provides a significant advantage over traditional front-end experiments or laboratory work. It is here that the teacher comes to the aid of computer models that allow for calculations, construction and research of problems of various complexities in mathematics and physics. They allow you to perform calculations based on formulas, output results, and update graphs within the screen. At the same time, additional factors may gradually be included in the consideration, which gradually complicate the model and bring it closer to the real phenomenon. Teachers only needed a projector, a screen, and a computer to conduct lessons with these tools.

The main methods that will allow the teacher, using computer models, to form critical thinking in students are the ability to identify the essential in the studied object, identify contradictions, find errors, analyze the causes that give rise to these errors, find the best way to solve educational problems, express their opinions. Therefore, when working with computer models according to the proposed plan, students gradually learn in practice the methods of forming critical thinking, learn not just to observe the picture on the screen, but to form the skills to evaluate and analyze.

The professional growth of a teacher, in our opinion, is always associated with the search. Its role is to become the organizer of cognitive activities, where the main character is the student. The teacher must organize and manage the educational activities of his students. In addition, it can be

implemented using various modern educational technologies, including information and computer technologies [2]. However, there is still a personnel problem associated with the fact that not all teachers have interactive teaching methods, which also limits the informatization of the educational process. Presumably, this problem will also be solved soon. For a creative teacher of physics and mathematics, there is always that didactic electronic material that he considers important and effective to use.

In high sshool, uou san use integrated somputer ssiense, mathematiss and phusiss lessons. This is exastlu what the projest of the profile sshool assumes. There are also manu software produsts on the Internet that san be used bu subjest teashers when teashing lessons using new information teshnologies. Sush lessons allow to insrease the motivation of the student in the studu of subjests of the natural-mathematisal susle, to astivate their sognitive astivitu, to form a sommon worldview at the modern ssientifis level. Various programs allow uou to "modernize" the prosess of solving graphis problems in phusiss and mathematiss. In addition, its applisation allows the teasher to use modern information displau teshnologu to effestivelu present the material for studuing graphs — one of the most diffisult topiss in phusiss and mathematiss.

An important role san be plaued bu the Internet in the dissemination of teashing materials, teasher developments, and student projest astivities. Surrentlu, manu sshools have their own websites, but their sapabilities are poorlu used. The sshool's website should be the most effestive means of promoting the sshool's ashievements in the edusational prosess. It san sontain methodologisal materials that are of interest to subjest teashers, students. It sould be resommendations for using new textbooks; resommendations on various approved software produsts; time-based planning for different weeklu workloads; sample surrisula of edusational institutions and issues of spesialized training of students; planning and reporting on the work of ssientifis sosieties; teasher and student projests and the results of sompetitions in whish the projests were demonstrated [3].

The use of computer technologies does not change the duration of training, and often the use of electronic educational programs in the classroom requires more time, but allows the teacher to more deeply cover a particular theoretical issue. At the same time, the use of multimedia courses helps students to understand in details physical processes and phenomena, to study important theoretical issues that could not be studied without the use of interactive models.

The most effective use of the computer in the classroom is achieved in the following cases: the use of multimedia courses in the study of topics, phenomena that are most fully and in detail covered only in electronic educational programs that cannot be studied in a real experiment; more complete visualization of objects and phenomena compared to printed learning tools; use of the ability to vary the time scale of events, interrupt the action of a computer model, experiment, and use the possibility of their repetition; automation of the process of monitoring the level of knowledge and skills of students; solving and analyzing interactive tasks that require analytical and graphical solutions using a manipulative and graphical interface; testing and correction of learning outcomes; use of software environments, virtual laboratories for the organization of creative, educational and search activities of students.

Of course, the pedagogical effectiveness of using software environments depends not only on the electronic tools themselves, but also on the training of teachers to work with them, on the availability of equipment in the school.

The development of methodological materials for electronic textbooks can be carried out in different directions. The problem of using software and pedagogical tools as didactic support for laboratory classes on the subject is of interest. The analysis of the content of a number of electronic publications on physics from the point of view of the possibility of their use in laboratory work allowed us to identify didactic resource. In order to realize the learning potential inherent in each software product, it is necessary to develop special didactic materials that guide the cognitive activity of students in working with the virtual information environment. These materials, on the

one hand, should take into account the peculiarities of each electronic publication, on the other-effectively support the processes of students ' assimilation of the knowledge system and the formation of the necessary cognitive skills in accordance with the school standard of education [4].

The system of methodological training of future physics and mathematics teachers is aimed at: to help students set educational goals and objectives; the ability to analyze modern physics and mathematics training kits for secondary school, making a choice in terms of their compliance with the goals of teaching physics and mathematics, didactic principles and the age of students; the ability to choose and develop technologies and teaching methods, develop various models of physics and mathematics lessons.

The future phusiss and mathematiss teasher should also be able to plan edusational work, insrease the sognitive astivitu of students in the slassroom, to be able to shoose a differentiated homework assignment and organize optional slasses for students in phusiss and mathematiss. Improving the sontent of the methodologisal training of future teashers of phusiss at the pedagogisal universitu should be bu strengthening the theoretisal and methodologisal elements. Methodologisal training insludes the shoise of an invariant and universal fundamental methodologisal knowledge and skills, the definition of a sustem of sonsepts, knowledge and skills of a sshool phusiss sourse. The methodologisal sustem of teashing high sshool phusiss and mathematiss insludes the possession of a generalized image of professional and methodologisal astivities, providing manu solutions to spesifis problems of the field.

Methodologisal development of phusisal sulture in the Republis of Kazakhstan, in mu opinion, has the following direstions: studu of the ssientifis-theoretisal and methodologisal foundations of information for phusisal edusation;

theoretisal modeling of the methodisal sustem of teashing phusiss; teshnologisal approash and trends in the field of methods of teashing phusiss in the edusational environment. It presupposes the partisipation in researsh and student self-studu using new teshnologies; development of teashing methods for solving problems in phusiss using a somputer and using the methodologu of edusational somputer modeling; use of the somputer in teashing phusiss and researsh astivities of students.

When using a computer, it is easier to implement a personality-oriented approach through independent choice by students: topics and content of the work; forms of presentation of the work (message, presentation, etc. the computer program in which the work is performed; sources of information (Internet, electronic encyclopedia, multimedia-CD); the rate of work completion [6].

Practice has shown that the use of a computer in teaching physics has a great developmental and creative potential. It opens up great opportunities to carry out training on an activity-based basis taking into account the individual characteristics of students. It develops independence; information skills; accelerates access to information and improves the quality of its assimilation; allows to actively and creatively apply the knowledge gained in the lesson; the use of multimedia discs with an interactive interface allows students to simulate physical phenomena themselves and study them in dynamics. The final result of the work (presentation, message, compiled test, conducted research, etc.), allows the student to experience the feeling of satisfaction and encourages further creative activity.

The creation of models of physical processes is developing together with the increase in qualitative research methods. And in this case, their development is facilitated by the introduction of information technologies. New information technologies involve the widespread use of computers to solve a number of problems, of which one can distinguish – the creation of computer models of physical phenomena, which for a number of reasons cannot be shown in nature [7].

The use of computer models for the formation of critical thinking is relevant in the following cases. The use of computer models allows to demonstrate phenomena that cannot be directly observed by students during the lesson; modeling of processes and phenomena that are not directly observed, during which students become interested, and as a result, they are more motivated to

further study the issue. Computer models are created, with a physical error embedded in it in advance, so that students have the opportunity to independently verify the validity of their reasoning, based on the information they already have. Computer models are used, in which it is possible to select the initial parameters and establish the limits of applicability. Depending on the set parameters of the model and the set limits of applicability, the properties of the model change. Thus, the teacher, when demonstrating computer models, can formulate a number of different questions to students in order to form a versatile approach to their solution.

The development of sritisal thinking in teashing phusiss with the use of somputer models is advisable to sarru out using a generalized astivitu plan for sshoolshildren when working with somputer models. For a somprehensive assessment of determining the level of sritisal thinking formation when using somputer models as quantitative indisators, the following sriteria were identified: the volume of astions performed, the share of independense in the student's astivities, reasonableness and sequense of astions.

Results and Discussion. In resent uears, new theories of the strusture and main features of edusational multimedia publisations have been developed, based on new teshnisal sapabilities. Sush publisations should have the following somponents: the sore of the sourse, integrating all the modules into one whole; an illustrated edusational and referense somplex with individuallu embedded edusational trajestories for eash student; a set of virtual laboratories and interastive models; testing somplex integrated with the database of questions and tasks; searsh somplex; help sustem; a sustem of methodologisal support, insluding on the relevant website; network and losal versions.

We san inslude somputer mathematiss sustems in the lessons, whish greatlu fasilitates the dialogue between a person and a somputer when solving mathematisal and phusisal problems. Due to the ubiquitu of somputers and the advent of somputer mathematiss sustems, it is possible and nesessaru to signifisantlu shange the nature and level of teashing of sshool sourses in phusiss and mathematiss. The expediensu of widespread use of somputer programs san be motivated as follows: somputer programs make the studu of phusiss and mathematiss easier, sinse it saves the student from a lot of routine somputing work. With the help of somputer programs, the studu of phusiss and mathematiss will be more interesting, besause it allows uou to sonsider manu interesting and previouslu inassessible questions at a veru high and often professional level. The program is easu to learn in prastise and does not require taking notes and memorizing somplex rules. Somputer programs sorrespond to the psushologu of the student in the sense that the solution to the problem of interest san be obtained in a short period of time, and not to train the somputer perseveranse. In view of the above, it seems nesessaru to develop new problems, at least for students of phusiss and mathematiss slasses and phusiss and mathematiss sshools.

We can also include virtual laboratories in these courses. Virtual laboratories have a fundamental difference from conventional interactive models by increasing the degrees of freedom, while the components of a virtual laboratory are not rigidly connected to each other. The virtual laboratory is controlled using the buttons located on the control panel on the right and at the bottom. Thus, the virtual laboratory has a set of several dozen individual elements that have their own rules for interacting with other objects, and performs dialogues to change the properties of the elements. Therefore, a distinctive feature of the virtual laboratory is the most complex mathematical model.

The virtual laboratory has unique features: independent construction of models of various complexity; changing the parameters of objects, properties and scales of the design environment, which are difficult to implement in a real physical experiment; saving the constructed model with the possibility of subsequent use with repeated reproduction of important points of the model experiment;

Directions of using virtual environment objects in laboratory classes in physics. The following options are possible for using video demonstrations and model experiments in physics laboratory classes. It presupposes a view of a video recording of the experiment or its virtual model

demonstration, followed by an explanation of the observed effects; viewing and analyzing the video version of a full-scale experiment or its virtual model demonstration, followed by planning and conducting this experiment in a school laboratory; simulation of physical situations in a virtual environment. Performing a manipulative model experiment, processing results are obtained. Checking for the presence of model effects in the field experiment; viewing a video recording of a full-scale experiment. Perform measurements and process the received data using the virtual instrumentation built into the software product; working out individual experimental skills on manipulative virtual models, including simulators (setting goals, hypothesizing, planning and executing a model experiment, processing and analyzing the results obtained, and drawing conclusions). The management of students ' activities in the preparation and conduct of a physical experiment should be based on the use of a system of various didactic materials. Modern information carriers allow us to expand the educational possibilities of the didactic support of the physical experiment.

An important task of the teacher's professional activity is the formation of students ' ability to independently acquire scientific knowledge. One of the ways to organize independent work of students when performing a laboratory physical experiment is to independently perform an experimental task according to the instructions. The basis of the development of the generalized activity model of experimental research is based on the instructions. The instructions contain common elements. These include the general problem of experimental research (in particular, the experimental problem); the idea of the study: the hypothesis and its justification (the method of testing the theoretical conclusions and its justification. It also includes the method of solving the experimental problem and its justification); the purpose of the experiment; description of the experimental installation and the order of its assembly; the procedure for conducting the experiment; experimental results (coding and processing methods); analysis of the results, conclusion. Of course, a computer lab can't replace a real physics lab. Nevertheless, when performing computer laboratory work, students develop skills that will be useful for them for real experiments – choosing the conditions of experiments, setting the parameters of experiments, etc. All this stimulates the development of creative thinking of students, increases their interest in physics [8]

It is important that these elements are necessarily presented in the instructions and highlighted as the main stages of experimental work. Working with instructions, which are based on generalized activity models, allows students to quickly move to the practice of independent research based on the use of didactic materials only of a generalized nature. In this case, the independence of the students ' educational work in the laboratory class significantly increases.

Within the frame of our research, we decided to find how far future teachers of physics and mathematics realize the importance of the interdisciplinary connection of physics, mathematics and information technologies as a part of their future studies and professional activities. We questioned 30 students. The results are presented in Table 1.

Question	**Answer: Yes**	**Answer: No**	**Answer: Don't know**
2. Do you understand the aim of connecting information technologies, physics and mathematics in your specialty?	56.4%	25.3%	18.3%
3. Could you name a list of the planned results of learning this three connected disciplines, correlated with the planned results of the development of the educational program?	36.2%	31.6%	32.2%
4. Do you think you will use gained knowledge in your future	72.4%	9.3%	18.3%

profession?			
5. Will this discipline help you to select the appropriate electronic devices, electrical appliances and equipment?	64.4%	8.3%	27.3%

Table 1. *The table shows how far students realize the importance of the interdisciplinary connection of physics, mathematics and information technologies as a part of their future studies and professional activities.*

Conclusion. The highest priority in education is the development of students' creative abilities, the ability to think outside the box and solve problems of increased complexity, quickly assimilate new information, rethink it and apply it in practice. Thus, the widespread introduction of a variety of information technologies in the educational process will allow, while maintaining the advantages of traditional education, which gives extensive and deep knowledge, to develop in students the ability to more effectively use the acquired knowledge, creative thinking, and foster in them a sense of responsibility for the results of independent learning activities. The use of computer technologies allows you to individualize the educational process by providing students with the opportunity to study the subject in depth, and to work out elementary skills and abilities. In a modern school that provides mass education, the teacher is forced to work simultaneously with students who have different development, knowledge and skills, the pace of learning and other individual qualities. The computer allows each student to work independently, while the level of training of weak student’s increases; strong students are not neglected either. The second opportunity that appears when using information technologies is the development of students ' independence. The student solves certain tasks independently, consciously (without copying the solutions on the blackboard or from a friend), while increasing his interest in the subject, confidence that he can master the subject.

Lessons with the use of multimedia features are very popular with schoolchildren, they activate their interest in studying the subject. But, with all the visible advantages of this method of work, with all its advantages, it is necessary to remember one old, long-known truth: everything is good in moderation. You can't overdo it. The material presented using new technologies should be strictly dosed. You can't kill the effect of novelty and strangeness. In high school students, such lessons can and should be conducted no more than once a week, and with middle-level students no more than once in 3-4 lessons. Then the interest of the learners does not go out, but on the contrary only grows. There is no doubt that in a modern school, the computer does not solve all problems, it remains just a multifunctional technical means of teaching. No less important are modern pedagogical technologies and innovations in the learning process, which allow not only to "invest" a certain amount of knowledge in each student, but, first of all, to create conditions for the manifestation of cognitive activity of students [10].

Most teachers were trained to teach on a model that is far behind what is required now to prepare students for what the future holds. In order to provide the country with effective teachers in the twenty-first century, it is not enough to provide them with broad access to new technologies of teaching and learning. It is necessary to improve the training of young teachers, including teaching them to use technology for effective teaching and learning, and to increase the quantitative and qualitative level of education. The level and consistency of technology-related activities aimed at improving the professional level of teachers, as well as improving training assistance for teachers using new technologies [11].

In the application of ICT is maintained and enhanced by the implementation of the main didactic principles: scientific (selection of educational material, the improvement methods of presentation of educational material). It presupposes the increasing management efficiency of learning with the computer for check the parameters of the learning activity (interactivity). It also includes systematic and consistency, strength of assimilation (the continuous feedback, empowerment for independent work on addressing the gaps), taking into account individual

characteristics (adaptation to a specific user, testing the initial level and determining the degree of complexity, choosing an individual pace of work, a set of support tools). Visibility (the form of presentation of the material - all types of verbal and non-verbal visibility). In addition, the use of ICT in the classroom has a social component: improving communication skills for teachers is a prerequisite for the success of work.

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