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THE IMPLEMENTATION OF INTERDISCIPLINARY APPROACH IN TEACHING MATHEMATICS IN THE CONTEXT OF THE UPDATED CONTENT OF EDUCATION

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Annotation: The scientific work considers ways to implement interdisciplinary communication in the teaching of mathematics in the context of the updated educational content. The content of the monograph is aimed at defining the essence and functions of interdisciplinary communication in the program of high school mathematics by showing the STEM method and the use of information and communication technologies on the example of topics of equations and inequalities. The research is intended for high school maths teachers, university teachers and interested readers.

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Content

Normative references

References to the following standards are used in the written scientific paper:

- Law of the Republic of Kazakhstan on education
- State program for the development of education of the Republic of Kazakhstan until 2025
- State mandatory standard of education of the Republic of Kazakhstan (primary, basic secondary, general secondary education)
- Training program (based on subject)
- Curriculum (based on subject)
- Rules for criterion-based assessment of students ' academic achievements in education all organizations that implement general education programs(primary, basic secondary, general secondary education)
- Guidelines for criterion-based assessment for primary / Basic Secondary and general secondary schoolteachers
- Methodological guide for formative assessment
- Methodological guide for summative assessment
- Evaluation criteria, task templates, descriptors, score, section categories

Definitions

In this scientific paper, the following terms are used with appropriate definitions:

Evaluation (appraisement) – is an activity aimed at systematic and critical analysis of the educational process and results, based on which conclusions, decisions and/or recommendations related to the current and subsequent educational process are developed.

Assessment criteria – a statement that evaluates how much work a student has done correctly (when performing a summative assessment).

Assessment criteria is a rule, justification for making a decision to evaluate something in accordance with the requirements. Each criteria on has descriptors (for each specific work) that give a clear idea of the correctness of the result of completing a school task. According to the descriptor, the assessment determines the achievement of the student's goal.

Achievement criteria is a statement that is recognized by teachers and students about the achievement of the learning goal.

Summative assessment (learning assessment) – is summing up the result soft training for the purpose of classification, certification and registration of learning outcomes. Summative assessment is carried out at the end of training cycles and stages and is an indicator of the student's level of training at a certain stage, carried out on the basis of unified assessment criteria.

Criteria based assessment – based assessment-an assessment that allows students to adjust their own learning in order to achieve the expected results of educational achievements in accordance with the purpose of learning according to pre-known criteria. Allows you to

evaluate the development of students' skills.

A formative assessment (assessment for learning) is a current assessment conducted by teachers in accordance with the purpose of learning, which is part of teaching and learning. Formative assessment or assessment for learning is a current assessment of learning that provides teachers, students, and other participants in the pedagogical process with the information they need to improve their learning.

Intra-school assessment (school-based assessment) – an assessment carried out within the framework of classroom work with teachers.

Moderation is a process in which teachers discuss students' work in a single subject and class, ensuring that the assessment is fair and honest in order to standardize grades.

The results log is an electronic document that records the results of formative and internal summative assessments and calculates quarterly, annual, and final estimates.

Internal summative assessment (ISA) – an assessment that determines the formation of reading skills and knowledge at the end of the quarter at the end of the study block.

Test specification – a document consisting of a table for scoring points, the main requirements for conducting an assessment, evaluation tasks, and a description of goals. It consists of a sample of tasks and questions.

Quarterly grade (mid-term evaluation) - A grade that is set for students at the end of the quarter, consisting of a certain percentage of the results of the formative assessment and internal summative assessment.

Reflection – an overview and reflection of how well students have mastered the lesson in the course of learning.

Signs and abbreviations

SMC - system and methodological complex
CBA - criterion-based assessment
RK – Republic of Kazakhstan
MES RK - Ministry of Education and science of the Republic of Kazakhstan
FA - formative assessment
ISA - internal summative assessment
AT - assessment for training;
CIS - Commonwealth of independent states
UNT - unified national testing

INTRODUCTION

Changes in the socio-economic level of society, transformation of all spheres, dynamic sustainable development of Science and technology, information technologies, affecting the education system as a whole, its components, today require new aspects of modernization and improvement of the education system.

The multi-level structure of the education system requires, first of all, the presence of Basic Secondary Education in a qualitatively new system, which is formed in general education secondary schools. The rapid acceleration of the process of updating knowledge, the emergence of new technologies and special programs in the field of education, the provision of production facilities with new technologies in a short period of time require not only high-quality knowledge, but also a high level of professional mobility, the ability to work independently in a very large amount of information, constant replenishment and updating of their professional knowledge.

In the state program for the development of education in the Republic of Kazakhstan until 2025, the basic level of the education system is secondary education, the goal of which is defined as "the development of human capital by ensuring the availability of quality education for sustainable economic development, increasing the competitiveness of Education". The right to receive it for free is guaranteed by the Constitution of the country. In the system of Secondary Education, there are problems related to the poor material and technical, educational and methodological base, as well as the need to update the content and methods of teaching" [1]. That is, according to the concept presented in the state educational standards today, the education system should primarily "satisfy the spiritual interests" of the individual, meet specific human needs. The purpose of implementing these concepts is to create a structure of knowledge that focuses on actions of a theoretical and applied nature, as well as the cultural implementation of education and upbringing.

Thus, any educational institution today should create conditions for the formation of a student in the educational process as a person with a high culture, fundamental professional training, capable of independently searching for new knowledge, mastering new techniques and technologies, their special tools.

Taking into account the requirements of society to a person, analyzing several regulatory documents at the state level, we can say that today one of the most important tasks of educational institutions is the education of a creative, active person, has his own opinion, has developed organizational skills, has a wide field of thinking, quickly perceives new things, is competent. Information of the Republic of Kazakhstan from such regulatory documents together with the law of the Republic of Kazakhstan " on amendments and additions to some legislative acts of the Republic of Kazakhstan on amendments and additions to some legislative acts of the Republic of Kazakhstan." Theoretical and practical experience shows that in order to form these qualities, it is necessary to constantly improve the teaching methodology [2,3].

Today, a person should be able to analyze the phenomena that occur in society, solve production tasks. One of the goals of teaching mathematics in general education schools is to form the knowledge and skills necessary for their future professional activities, as specified in the Standard [4]. In this regard, they need to develop a level of mathematical training that requires the ability to analyze the problem, choose ways to solve it, and formulate the problem, as well as make the most extensive use of the capabilities of special programs in the field of Education together with information technologies.

It is true that most students of secondary general education schools do not understand the purpose, application, and relationship of subjects, including mathematics, and do not understand that students should apply the knowledge gained as a result of studying mathematics to specific situations. It is therefore not possible for other subjects to demonstrate their mathematical knowledge in

applying the subjects of mathematics to each other. All this negatively affects the entire process of teaching mathematics.

The issues of improving the teaching of mathematics in general education schools in accordance with the new requirements are closely related to the structure of several of its actual ideological networks and the improvement of methods of teaching them. One of these topics is the topics assigned to percentages that are of App value. Percentages are widely used in various fields of mathematics, other sciences, and in solving important applied problems. Therefore, the problem of students ' assimilation of these topics in the areas of application, theoretical-mathematical and other content networks of mathematics courses is inextricably linked with the problem of conscious assimilation to the level of analysis of teaching materials for solving problems.

In the traditional teaching of mathematics in general education secondary schools, there is a need to improve these topics based on the integration of learning topics, analysis of learning outcomes, and still taking into account innovations and changes in the methodology, the updated content of Education. And there is no doubt that the problem of conscious and high-quality assimilation of the content of mathematics by students directly depends on the depth of mathematical knowledge, methodological skills, creativity, and visual aids used by mathematics teachers. Therefore, it is obvious that there is a need to improve the teaching of the analyzed topic in the school mathematics course, taking full advantage of the possibilities of integration of teaching topics.

In the methodology of teaching mathematics, interdisciplinary communication in teaching topics assigned to percentages was based on the choice of geometry, information and communication technologies, physics, taking into account the specifics of the updated content of education with the use of Information Technologies, the topic of our research work was taken as "implementation of interdisciplinary communication in teaching mathematics in the context of the updated content of Education".

The relevance of the topic of the research work today is as follows: There are few scientific papers in the Kazakh language devoted to the implementation of the relationship of educational topics in the process of teaching mathematics. One of the main trends in modern science in recent decades is the integrity of the processes of differentiation and integration. In the field of education, this trend has also taken place as the consideration of the integration of different topics within the same discipline. The problem of integration of educational topics is defined as a general scientific and pedagogical concept and is engaged in determining its mechanisms, levels and components, tools and characteristics, functions.

The second half of the last century was characterized by a very high intensity of practical activity of human life and the mathematic of science. Mathematics, which has long been the basis of Natural Science and technology, is expanding its application every time. The principle" every step we take, judge, measure, measure, assume the desired result, evaluate reliability, make a forecast, climb and so on, that we are engaged in mathematics " never ceases to make sense.

In general education schools, mathematics is usually referred to as algebra and geometry together, and in some of the materials of our work, we consider it as a whole. Given topics of study related to percentages in algebra and geometry, taken as an example, are fully analyzed in this paper.

We consider the interdisciplinary connection on the topic of our chosen work in the context of the updated content of Education. The content features of these updated curricula are several: the principle of "scroll" when designing the content of the discipline; hierarchy of educational goals based on the laws of cognition according to bloom's taxonomy; the formulation of pedagogical goals by levels of education and throughout the course of training, which allows us to take into account interdisciplinary connections as much as possible; availability of common topics for the implementation of links between disciplines within the field of knowledge, compliance of the content of sections and proposed topics with the requirements of the

time; technology of the educational process in the form of long-term, medium-term, short-term plans.

Another feature of the new training programs is their focus on the formation of not only subject knowledge and skills, but also a wide range of skills. The system of educational goals is the basis for the development of a wide range of skills: functional and creative application of knowledge, critical thinking, research, use of information and communication technologies, the use of various types of communication, the ability to work individually and in a group, problem solving and decision-making. The flexibility and versatility of the updated curriculum is its most important characteristic. Teachers have the right to independently determine the order of teaching chapters and sections within the framework of the chapter and the corresponding quarter. Teachers can create tasks aimed at achieving several goals. The curriculum allows teachers to divide the learning goal into several goals that lead to the achievement of the learning goal in the curriculum, provided that the learning goal is fulfilled in a set.

The search for new scientifically based ways to improve the learning process by integrating educational topics determined the content and structure of our work. One of the main principles of organizing the classification of topics of school mathematics is the definition of the content and methodological line, that is, the distribution of topics studied for several years in the transition from one class to another, not breaking the connection with the topics of the previous discipline, establishing a connection between concepts and methods of solving problems. The integration of educational topics creates conditions for a clear and sequential presentation of this scheme. We have already mentioned that one of the most important topics of mathematics that requires compliance with this chain is the topics for percentages. These topics take place not only in algebra, but also in geometry, physics, chemistry, and even biological calculations, and the student's knowledge and skills in solving them are related to algorithms, logic, etc., which contributes

to the student's mastery of the applied direction of mathematical science. D. A. "Kryzhanovsky noted that "in the study of the real world and the world, the percentages are also important for the table, as well as Ravenna" [5]. That is, the importance of this topic is special.

Today, all schools of the country will provide teaching on the updated content of Education introduced into the educational process. The curriculum sets the goals and values of each subject, and briefly describes pedagogical approaches in accordance with the position of the teacher. This document contains information about the structure and content of each discipline. The content of the curriculum is presented by sections, subsections, and general topics. Analyzing this topic, we can say that the article of a scientist of Kazakh origin, teacher Zh. Aimauytuly, published in the Kazakh publishing house in 1929, was guided by one of the following lines: the topic should be purposefully cognitive and increase the knowledge of the child. It is necessary to study not only the beginning of things but also the whole meaning of things in life. [6].

If we analyze this word, each student should understand the knowledge that they have received in different ways at the end of each lesson and be ready to apply it to the future. The main problem of this work is the use of special programs in the implementation of interdisciplinary communication in mathematics in order to master the selected topics as deeply as possible. The analysis of the scientific and methodological literature, the experience of teaching mathematics showed that there is a contradiction between the theoretical requirement and practical implementation. If the improvement of the educational process is carried out by replenishing the content of the subject, today it is necessary to use various technologies in the learning process, to improve, supplement and update the learning process every day. Based on the analysis of school practice, it is noted that the effectiveness of the lesson depends more on visual and explanatory materials. Therefore, in addition to the integration of educational topics, the correct

implementation of interdisciplinary communication also contributes to this.

The object of the study was the tendency to teach students mathematics in general education schools.

Forecast based on the analysis of theoretical materials: if in the process of teaching mathematics interdisciplinary communication is carried out systematically and purposefully with the help of special programs, it contributes to improving the effectiveness, regularity of the learning process, knowledge and skills of students according to the following parameters:

- improving the quality of mathematical education and professional development;
- formation of students ' motivation to study mathematics;
- increase activity and skills of independent work.

According to the purpose of the study and the forecast, the following separate tasks were set:

1) to determine the theoretical foundations of the implementation of interdisciplinary communication in teaching mathematics to students in general education secondary schools;

2) analysis of the content of interest reports and methods of teaching them through special programs;

3) determining the principles of establishing interdisciplinary communication, taking into account the specifics of the updated content of Education;

4) development and testing in practice a methodology for using the capabilities of special programs through interdisciplinary communication in teaching mathematics to students in general education schools.

Theoretical and methodological foundations of the study:

- theory of interdisciplinary communication;
- theory of effectiveness of the learning process;
- theory of application of special programs in the learning process;
- regulatory documents on the updated content of Education.

The paper also used works devoted to the problem of integration of courses in algebra and geometry [7,8]. To achieve the research objectives, the following research methods were used:

- analysis of psychological, pedagogical, scientific, methodological and mathematical literature on the research problem;
- analysis of educational standards in mathematics of general education schools, educational documents, special programs prepared in mathematics;
- generalization of the experience of teachers who use special programs for interdisciplinary communication in the process of teaching mathematics;
- pedagogical experience.

Practical significance of the research work:

- ways to implement interdisciplinary communication in the process of teaching mathematics;
- this analysis was shown on the example of topics given to interest;
- in the process of teaching mathematics in general education schools, a methodology has been developed on the example of interest topics in the implementation of interdisciplinary communication with the help of special programs;
- a short-term plan has been prepared on the topics of interest in accordance with the requirements of the updated content of Education.

The goals and content of education are changing, new means and technologies of teaching are emerging, but no matter what reforms are implemented, the lesson remains the main form of learning. It supported the traditional education system, as well as the updated content of secondary education in the Republic of Kazakhstan. Any lesson has a huge potential for solving the tasks set by the updated program. In accordance with the main ideas of the Program, the lesson is based not on the topic of the lesson, but on the learning goals and expected results. The lesson that focuses on learning should be planned on the basis of clear and reasonable

goals. Many people lose interest in learning, they either do nothing, or begin to violate discipline. In order to avoid such situations, each teacher first of all needs to consciously and deliberately approach the lesson planning and take into account the inter-subject relationship.

A short-term plan, or lesson plan, is drawn up by the teacher independently according to an approximate template presented at the end of the curriculum. Planning is a useful thing, a serious attitude to planning allows you to analyze every upcoming step, but at the same time you need to remember that if teachers force students to perform tasks that they are not interested in just because these tasks are planned in advance, real training stops. A teacher working on the updated content of secondary education in the Republic of Kazakhstan must be mobile and at the end of the lesson must analyze it. The teacher's actions should be aimed at an effective lesson aimed at learning.

Practical materials are used in the performance of individual works by teachers in teaching mathematics in general education schools. The work creates textbooks, manuals, current publications and internet materials of domestic and foreign authors on mathematics, methods of teaching mathematics, improving the methodology, using information and communication technologies, Special Programs (website of the Center for improving pedagogical skills, website of the National Academy of Education named after I. Altynsarin, etc.), regulatory documents on the updated content of education, materials of special publications, materials of scientific conferences.

The authors of the monograph worked in different directions to prepare the content and prepare it for publication. In particular, the preparation of the content and the introduction of the first and second chapters of the monograph by U. A. Kossybayeva, the writing of the content and the conclusion of the third and fourth chapters by D. M. Akhmanova, the fifth chapter and the preparation of normative documents, references, appendices by D. A. Kazimova.

I THE ESSENCE AND FUNCTIONS OF INTERDISCIPLINARY COMMUNICATION IN TEACHING SECONDARY SCHOOL MATHEMATICS

1.1 The importance and place of interdisciplinary communication in the process of teaching secondary school mathematics

Socio-economic changes in the country have an impact on the education system in general, including pedagogical ones. A modern school needs teachers who are able to use theoretical knowledge, professional abilities and skills as a whole, have a high level of pedagogical thinking, and are able to solve pedagogical tasks creatively on their own. The Ministry of education and science of the Republic of Kazakhstan also pays great attention to the improvement of education annually. The decline in students ' mathematical knowledge justifies the need for a new approach to the process of mathematical education. The state mandatory standard of education of the Republic of Kazakhstan provides for the task of education aimed at the formation, development and professional development of the individual on the basis of national and universal values, achievements of Science and practice, and improving his creative, spiritual and physical strength, creating conditions for the comprehensive development of the individual [9].

The concept of general interdisciplinary communication has been found in the scientific literature since the XIX century and is interpreted as reconstruction, complementarity, and integration. This interpretation provides for a wide application in various fields of human knowledge. The emergence of this concept in pedagogy and its development are connected with the trends that take place in the educational space [10]. In some textbooks, interdisciplinary communication is also considered as the integration of disciplines.

Currently, integration has become crucial and has become a priority for the development of the education system. First, the changes that are taking place in this direction are the result of the systematic development of Science, the emergence of new disciplines of scientific analysis. The emerging phenomena are actually of an integrative nature, defining the general disciplines of research for various sciences. Secondly, selective trends in the development of pedagogical science are a reflection of efforts to find and study new phenomena of pedagogical reality, establish their properties and identify theoretical principles and methodological tools that have characteristic features corresponding to the scientific object of research. In the 2014-2015 academic year, the methodological guide on the peculiarities of teaching the basics of Science in organizations of general secondary education of the Republic of Kazakhstan (including those that carry out Inclusive Education) states: new teaching of the subject in secondary schools is the only way to form a true national patriotism and consolidate our spiritual identity and ideological ideals. In the course of teaching the subject, students should be guided not only by the full assimilation of knowledge, but also by the presentation of cultural values, customs and traditions based on national education, the enrichment of the language fund of students, the regularity, continuity, continuity of knowledge, the historical nature of the content of education and the principles of interdisciplinary communication [11].

When implementing state educational standards, it is mandatory to form general educational skills and skills, as well as methods of activity, the level of which largely determines the success of all subsequent training. Currently, the use of approaches and methods in the educational process that create new knowledge, collect the necessary information, propose hypotheses, draw conclusions and form mental judgments is becoming relevant.

Mastering universal educational activities allows students to successfully master new knowledge, skills and competencies, including the organization of assimilation, that is, the ability to learn

independently. Interdisciplinary connections play an important role in the development of students. They contribute to the better formation of interdisciplinary concepts, i.e., concepts within individual disciplines, groups, and systems that no particular subject can give students in the classroom. The need for communication between academic subjects is explained by the didactic principles of teaching, the educational tasks of the school, the relationship of teaching with life, and the problems of preparing students for practical activities. The implementation of interdisciplinary connections helps to form students ' holistic understanding of natural phenomena and the relationship between them, so that knowledge is more important and applicable in practice, which helps students use the knowledge and skills acquired during the study of one subject, when studying other subjects, in specific situations, it allows you to use it in educational and extracurricular activities, when considering individual issues in the future industrial, scientific and social life of school graduates. When implementing interdisciplinary connections in teaching mathematics, the methodology of selecting materials from courses of other academic disciplines and using them for mathematics lessons is of great importance. Students choose the information they receive when studying various subjects for their classes, and first of all pay attention to the program and to what extent these issues are considered in the relevant school textbooks.

An effective form of small research work on various disciplines, in which a single topic is combined, is the implementation of general interdisciplinary links. The high level of information and cognitive formation of students is facilitated by the use of references and additional literature in mathematics lessons, the search for information. Students actively use the found interesting information in performing various creative tasks.

Generalizing all of the above, we generalize the concept of integration as follows: We understand integration as one aspect of system development as an objective process of merging previously fragmented elements into a new quality with signs of unity.

Interdisciplinary communication carried out in the educational process increases the level of worldview of students and allows them to use their knowledge from other branches of Science for their own purposes. For example, the subjects of the Natural Science cycle it forms the worldview of students, since the materials transmitted in the cognitive direction are directly related to the content of Natural Science subjects.

It can also be found in many textbooks that the concept of interdisciplinary communication is interpreted through integration. We have described that integration is a legitimate process of continuous alternation of moments of formation and development, which takes place in order in a single formation of many previously dispersed components. Integration-combining parts in such a way that they come out as whole, connecting them in such a way that they become one whole. From this point of view, it is more effective to study materials related to certain disciplines in an integrated way, so that their content is widely covered, than to pass them separately within a certain discipline. Integration is a comprehensive assimilation of the material, an effective method of applying students ' knowledge gained in the classroom in life practice. At the same time, it is useful to strengthen the student's intellectual, moral, and aesthetic views, effectively use the term of study, and manage the educational process [12]. Interdisciplinary communication in general is one of the most used learning trends at the present stage. It regulates legal relations between subjects, harmonizes the continuity of students ' knowledge with each other, and allows students to apply the acquired knowledge in a complex way. Interdisciplinary communication is generally classified as follows (figure 1):

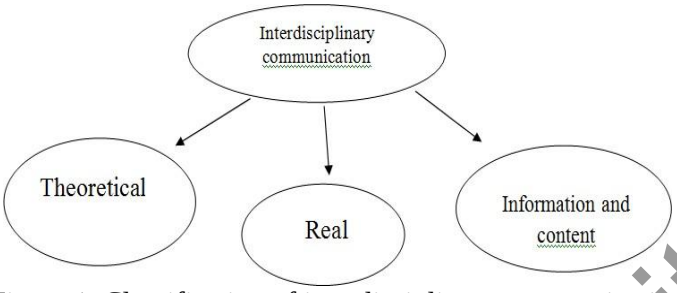

Figure 1. Classification of interdisciplinary communication

In any lesson, stages are mandatory, so an individual approach is very important in each lesson, for example, for weak students – support notes, conversations with them, which activates children in the lesson through various questions with high-level students. Questions can be complex and simple, pass on the study, and often acquire an analytical character. Students have the right to give an oral or written answer. It is very effective in using tasks of different levels of complexity when performing design tasks.

Today, according to the updated content of education, through the "Spiral Dynamics", different methods of teaching students of different levels are used. Understanding why" Spiral Dynamics " is essential for every teacher. Knowing what level the student is at and what their attitude to various ways of obtaining information is, the teacher can make a short-term lesson plan. On the basis of the principle of" Spiral Dynamics "or" spiral learning", the laws of learning levels and level-to-level transition are well covered. It is important to pay attention to the fact that in our development we can gradually move from level to level, and it is impossible to jump the level again. As for the spiral level (marked with the corresponding color codes in the text), our consciousness will be in one of three options:

Open-we recognize that all approaches to learning are accessible at our level and at our low level, as well as open for the transition to the next level.

Closed-the movement towards a higher level of learning is inaccessible and closed, the person does not even notice these opportunities or denies their existence. At the same time, there is an opportunity to rely on previous levels that have already passed.

Semi-closed means of learning are used only from the current level of perception, the rest are not available, because they are rejected, displaced. Other ways of learning are considered unacceptable by a person.

A special feature of the curricula for the updated content of education is the focus on the formation of subject knowledge and skills, as well as a wide range of skills: functional and creative application of knowledge, critical thinking, conducting research, using ICT, using various communication methods, the ability to work in a group and individually, problem solving and decision-making.

For the effective implementation of the goals and approaches of the draft curriculum, it is necessary to organize the learning process based on concepts that contribute to the formation of historical consciousness of students ' skills. The content feature of the updated educational programs is the spiral principle of planning the content of the subject, rethinking the knowledge and understanding of students as they move from class to class, as well as the presence of "common topics" in one educational area and interdisciplinary communication. Such a "spiral" allows you to better master knowledge and develop skills.

In the updated program, the concept of "criterion-based assessment" will be of particular importance. Much attention is paid to changing the system for evaluating the achievement of students ' expected results. If the traditional program uses a five-point assessment system in schools and the teacher has the right to decide for himself, it will be "four" or "five", and the criterion-based assessment involves a very open assessment, which is formative during the school year, that is, through feedback and for the study of the section and the final assessment within the quarter.

The results of students ' learning at school require teachers to comprehensively and objectively assess the achievements of each child in achieving the expected Learning Results, their attitude to learning and the dynamics of personal development in general. It is aimed at updating the education system and its content.

Today, the rapidly growing trend of globalization is increasing global competition. Even in a number of developed countries, this idea has become a national principle. Despite the fact that general education of a person is a large-scale problem, the need to form their skills and abilities arises from the progressive development of scientific, technical and socio-cultural achievements in the country. The system of teaching mathematics allows us to implement the general theory of teaching and educating future persons with the help of mathematics. The main task of teaching mathematics is to ensure the systematic and conscious acquisition of mathematical knowledge and qualifications sufficient for the further continuation of the knowledge necessary for daily breathing and work activities by each member of modern society. A mathematics teacher must have a complete knowledge of the General Laws of teaching mathematics, goals and content, methods and methods of teaching mathematics, methodological research, methods of solving problems and explaining them. Therefore, today, society and the state pay maximum attention to the education, education, and comprehensive training of students. The education policy carried out in the country is aimed at integration with the world educational space. The priority goal of general education in the world educational space is to prepare a person who can choose the right path and make positive decisions, quickly adapt to changing educational conditions. The modern school, meeting the needs of tomorrow in accordance with the achievements of Science and the demands of various spheres of human activity, should lay a solid foundation for the knowledge of the graduate necessary for his future life. Therefore, knowledge and flexibility should be devoted to building a knowledge system.

In general, the deep penetration of information technologies

into the education system has begun to change not only the methodology of its teaching, but also the content. In the field of mathematics, not only mathematical methods and mathematical thinking are updated, but also the general scientific worldview. We believe that before updating the content of mathematical education in schools and improving the methodology of its teaching, it is necessary to establish the quality of mathematical education. At present, education should have: Subject – Content, Content – activity, and content – personal connections. Mathematical education also depends entirely on mathematical literacy. Therefore, mathematical education and mathematical literacy should be twin concepts. Well, the problem of literacy is the main problem of the quality of training of a mathematics teacher. These issues:

–versatility of theoretical methods of the subject teacher;

- fundamentals of professional training of a teacher (courses, seminars, etc.)

- internal logic of discipline development, that is, the versatility of logical thinking. The goal set by every mathematics teacher today should be "to develop a system of mathematical knowledge and provide high – quality education, using the effective side of advanced information and innovative teaching technologies" [13].

Based on the experience of teachers who work in the direction of deepening students ' thinking, increasing interest in the subject, they are able to:

- ability to read the report in full;
- knowledge of theory and its combination with logic;
- formation of the ability to think quickly;
- development of vision, memory;
- teach you to see the effective side of the report;
- it sets goals such as improving the competence of the subject. It also uses elements of various technologies when necessary in everyday classes.

Today, the most effective way to raise Schools of the Republic

to the level of the world information educational space is to fully inform the education sector. Informatization is an organizational, socio-economic and scientific-technical process aimed at the formation and development of information resources and systems based on the use of communication technologies, the competence of solving an information problem in order to meet the requirements of individuals and legal entities for information. Today, it is clear that the need to involve citizens in large-scale computer literacy activities, skills in using computers, the internet and e-mail are a mandatory requirement. In this regard, in order to meet the needs of an informed society in the XXI century, we must solve the following tasks in the field of education: improving the quality of education through the effective use of computer technologies, the Internet, Computer Networks, Electronic and telecommunications means, and electronic learning in the educational process. Since the XXI century is the age of information, humanity needs computer literacy. And this first stage of literacy begins with school. Along with theoretical knowledge, it is appropriate to master the prerequisites for practical knowledge from the school. It is indisputable that a computer is needed to combine theoretical knowledge with practice. Therefore, one of the main directions of informatization of education is to create conditions for students to be able to work with information technologies and special programs. This will allow students to deepen their knowledge. According to the current trends, the use of video, audio equipment, televisions, and computers in everyday classes gives significant results. The use of special programs in any lesson not only increases the cognitive activity of students, but also creates conditions for the formation of a logical thinking system, creative work. At the same time, you can easily turn a traditional textbook into an electronic version of it. The success of this version is the ability to store it in computer memory, distributing it over computer networks. The use of information technologies in the educational process expands the capabilities of teachers and students. Therefore, it is indisputable that the harmonious use of Information

Technologies is becoming an urgent problem at the present stage. Today, there is a need to systematically implement and ensure systematic integration of information technologies in all areas of the education system [14]. At the same time," integration " means the unification of various sciences in the systematization and accumulation of knowledge, forming a pedagogical integrity.

The methodology of teaching mathematics is part of the system of Pedagogical Sciences. Depending on the specifics of the discipline, the course of mathematics cannot be completely replaced on a computer basis. For example, the development of students' abstract thinking through axioms, theorems, and their proofs should be carried out in traditional ways. Only when studying certain topics and chapters can you turn to computer technology. informatization of the education system and further development of problem-solving competencies is a new step in the educational system through the introduction of special programs in all subjects into the wider educational process. In this regard, the actual thematic goal of interdisciplinary communication is to expand students' horizons, increase interest in mathematics, improve cognitive communicative competence and information technologies of learning.

The rapid development of modern technology and technology requires any professional owner to quickly master new technologies and ideas. Therefore, the presence of a highly qualified specialist depends on the level of general and special knowledge, their correct combination. The role of general and universal solutions and research approaches in mastering equations and systems of equations is becoming increasingly clear. Such approaches can be divided into three groups.

The first group is to come to a solution using the logical method. Through these methods, the transition from the first equation and system to a new approach is carried out. Such transitions are made until tasks related to certain classes are completed.

The second group consists of computational approaches, which

are carried out by simplifying an equation or part of the system, as well as by checking the roots found by putting various intermediate calculations instead of the unknown. The role of computational approaches is observed when performing the task of finding a value close to the root of the equation. The ability to perform numerical calculations increases in the process of using meters.

The third group includes the visual and graphical approach. Most of these approaches are used on the basis of a coordinate straight line or coordinate plane.

The main goal of using new pedagogical information and communication technologies in teaching mathematics is to help students in the educational process. These purposes are served by such products as training programs, electronic textbooks to support lectures, verification programs, and animation programs. Pedagogical goals of information technologies in teaching mathematics:

- fast communication between the user and information and communication devices;
- computer visualization of learning information;
- automation of information and methodological control in the organization of the educational process.

The methodology of teaching mathematics is aimed at the formation of a student's own personality, the development of his worldview and intelligence, the study of adjacent subjects, the continuation of education and the formation and systematization of mathematical knowledge and skills necessary for future professional activities. But in most cases, the teacher does not have time to discuss and clearly illustrate the connections of its various sections.

Implementation of interdisciplinary communication in the teaching of mathematics in the context of the updated content of education is a new methodological system of teaching mathematics, one of the most effective ways to teach subjects in schools is to activate IC activities and increase students ' desire to learn. In this context, attention is paid to the organization of education in the main

school, improving the level of educational work and increasing its prestige. Currently, one of the most difficult tasks is to study effective teaching methods and recommend them for practical use in it. Mathematics and physics, taught in the main school, are of great importance in familiarizing students with objects and phenomena of the environment, systematizing scientific ideas about them, and forming their vision. There are many types of teaching methods in basic educational institutions. One of them is teaching mathematics based on the integration of educational topics. In order to fully express mathematical terms, rules, definitions and theorems, to be mathematically competent, of course, each topic must be absorbed by the student, reached his consciousness, and mastered. In each lesson conducted with these tasks, the rational use of interdisciplinary connections of educational topics will always bring results.

1.2 Ways to implement interdisciplinary communication in teaching mathematics in high school

Subjects of the natural and mathematical cycle in secondary schools teach students about living and inanimate nature, the material unity of the World, Natural Resources and their use in human economic activities.

The general educational tasks of these disciplines are aimed at the comprehensive harmonious development of the individual. An important condition for solving these general tasks is the implementation and development of interdisciplinary communication of coordinated work of subject teachers. The study of all subjects of the Natural Science cycle is closely related to mathematics. It provides students with a system of knowledge and skills necessary in everyday life and in the work of a person, as well as a system of knowledge and skills that are important for learning related subjects.

On the basis of knowledge in mathematics, first of all, general subject skills are formed. Continuity links with courses of the Natural Science cycle teach practical application of mathematical skills and abilities (table 1). This contributes to the formation of a unified scientific world view of students.

Table 1

The relationship of mathematics with school subjects

Subject	Mathematical content
Physics	Linear function, derivative of the function, straight line and inverse proportion
Physics (Mechanics)	Vectors, coordinate method, function graph
Computer science	Equations, inequalities
Geography	Scale, coordinate on the plane
Chemistry	Equations, percentages
Drawing	Parallel, perpendicular signs, angle measurement, scale, parallel Copying

The beginnings of algebra and mathematical analysis reflect the universality of mathematical methods, the main stages of solving applied problems. The axiomatic structure of the geometry course creates a basis for understanding the logic of building any scientific theory studied in Physics, Chemistry, and biology courses.In the course of teaching mathematics students in grades 5-6 are divided into interdisciplinary links with geography (scale, coordinates on the plane), computer science (coordinates on the plane, equation and inequality), economics (percentages, equations, inequality), statistics (diagrams).The problem of interdisciplinary communication is one of the most complex pedagogical problems that require the collective

experience of teachers to find their own solution. Therefore, it is important to organize the work of the entire teaching staff on this issue, observing a strict sequence of stages:

1) increase the interest of teachers, show the importance of interdisciplinary connections in teaching. Selection and distribution of methodological topics;

2) study of literature by teachers, teach them methodological approaches to the implementation of interdisciplinary communication, generalize the experience of teachers;

3) organization of practical work with the involvement of the entire teaching staff;

4) organization of a comprehensive, comprehensive use of interdisciplinary communication in all subjects;

5) clarification of methodological topics and coordination of various types of work with general topics in order to solve general educational and methodological problems.

Thus, the modern concept of interdisciplinarity of disciplines of the natural and mathematical cycle directs teachers to the systematic interaction of academic disciplines, the active implementation of interdisciplinary interaction in the content, methods and forms of Organization of training, extracurricular work, the widespread introduction of integrated lessons, elective courses that combine knowledge from various scientific and practical fields into the teaching practice.

Let's analyze many disciplines using examples:

1) Mathematics and chemistry. Since the introduction of various innovations in the practice of Chemistry by M.V.Lomonosov, the relationship between chemistry and mathematics has increased more than ever. In 1741, M.V.Lomonosov wrote in his work "elements of mathematical chemistry" that mathematics was the basis for many discoveries of chemistry. Physical Chemistry, Chemical thermodynamics, calculations in chemical apparatus, etc. mathematics is an integral part.

2) Mathematics and physics are the real thinking environment of many people. A physicist cannot read or understand the processes that he must learn from nature without Mathematics, and the direction of both is exact science.

3) mathematics and physical education. The Spanish scientist Luis Pacheco de Narvass developed his theory based on mathematical principles in his work "great steps". After this work, several scientific studies have been conducted and mathematical methods have been applied to physical education analysis.

4) mathematics and drawing. In the technique, thought is often written in numbers, images represented by numbers. The theoretical basis of drawing is geometry.

5) mathematics and geography. The relationship between the sciences of geography and mathematics has long been clear to mankind. This is evidenced by the emergence of the concept of" mathematical geography " today [15].

Among these disciplines, let's consider the interdisciplinary relationship between computer science and mathematics as the most familiar, easy-to-use, and accessible subject for both students and teachers. The use of information technologies in mathematics lessons also has its own features and advantages. In a broad sense, this concept means using various computer programs and technical means to make them as effective as possible for use. Multimedia technologies can be considered as an explanatory and illustrative method of teaching, which is used to convey educational material to students through the use of vision and to make their perception more productive. As a result of the research of researchers at the Institute" euro linguist", it turned out that most people remember 5% of what they hear and 20% of what they see. Simultaneous use of audio and video information increases the amount of memory material by up to 40-50%. Multimedia programs present information in a variety of forms and thus make the learning process as effective as possible. The time required to master the actual material can be saved in this way by an average of 30%, and the memorization of the acquired

knowledge will be as long as possible [16]. The use of multimedia technologies in the classroom does not radically change the structure of the lesson. In the structure of the lesson, all the main stages are preserved for a long time, only their description changes over time. It should be noted that in this case, the motivation period increases and becomes cognitive. This is a necessary condition for the result of learning, since the ability to visualize to replenish knowledge requires the creative activity of the student. Structural convergence of a multimedia presentation with the use of hypertext links develops consistency and the ability to analyze. In addition, with the help of presentations, you can use several types of Organization of cognitive activities: front-end, group, and individual. Thus, the multimedia presentation effectively and effectively corresponds to the didactic purpose of the lesson. Educational aspect: student's perception of educational material, perception of connections and relationships between educational objects. Developing aspect: the development of students 'cognitive interest, the ability to generalize, analyze, compare, and activate students' creative activities. Educational aspect: fostering a scientific approach, the ability to clearly organize individual and group work, fostering a sense of friendship, mutual assistance. In mathematics lessons, you can consider two types of ICT applications:

1. Multimedia-illustrations. These are text, images, photos, drawings, graphs, diagrams, audio parts of animation, and video frames on the screen.

Use of interactive communication capabilities of multimedia tools. Interactivity implies the existence of conditions for learning communication, one of the elements of which can be called information and communication technologies. In the lesson, it can be presentations for asking questions and getting answers by giving time, hyperlinks that allow you to return to the given material, for example, a return to the algorithm when solving problems, interactive computer programs activate all types of human activities: thinking, speech, and even physical, that is, accelerate the process of

mastering the material. Providing educational subjects, including mathematics, with a variety of programs: a textbook program, a trainer program, a library of dictionaries, encyclopedias, video tutorials, and electronic visual aids. Currently, there are many software products that can be used in general school math classes. In the geometry lesson, you can use such programs as" living geometry", Cabrigeometry, logo, Geometruinventor, Geommeter's sketchpad, and geometric constructor. During the lesson, with an emphasis on information and communication technologies, it is possible to master materials that are difficult for students to express in words, using presentations prepared using PowerPoint. This approach is now widely used in the educational process of general education schools in different parts of the country, and practice shows that in the lessons where presentations are used, students quickly master a large amount of educational material with interest. Here, the lessons are attractive, so the material presented will remain in the memory of the student for a long time. Currently, it is very rare for classes to take place without the use of a computer. The computer, of course, is not a substitute for the teacher, but it makes it easier to work, creates interest in students, and provides more opportunities for visual preparation for the perception of new material. Therefore, with the advent and widespread use of multimedia technologies and the Internet, Information and communication technologies can be used as a means of teaching and upbringing. Computer technologies provide the following opportunities: to gain time in the most intensive learning, to make the lesson attractive and diverse, outstanding, to involve all students in the educational process, to introduce innovations through computer technologies, to develop students ' creativity and ability to work independently. Today, practice shows that if you use a set of information technologies in the right way and in the right place, you can achieve the necessary level of educational quality. If we present the above briefly with a clear picture, then in secondary schools, communication with mathematics or mathematics can be done in the

same way as in the figure below (figure 2):

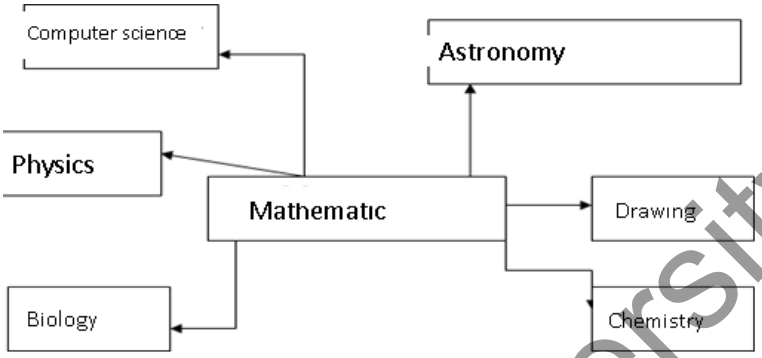

Figure 2. Interdisciplinary communication with mathematics

Thus, summing up the theoretical material, practice shows that interdisciplinary connections in school teaching are a real reflection of the integration processes taking place in the life of Science and society today. These connections play an important role in improving the practical and scientific-theoretical training of students. Generalization makes it possible to apply knowledge and skills in specific situations, in educational and extracurricular activities, when considering individual issues in the future industrial, scientific and social life of high school graduates. With the help of interdisciplinary connections, the tasks of teaching, developing and educating students are not only solved at a qualitatively new level, but also laid the foundation for solving complex problems of real reality in a complex way with a clear and sincere approach. Therefore, interdisciplinary connections are an important condition and result of a comprehensive approach to teaching and educating students.

Concept and classification of interdisciplinary communication. In the pedagogical literature, there are more than 30 definitions of the category" interdisciplinary connections", there are different

approaches to their pedagogical assessment and different classifications. Thus, a large group of authors defines interdisciplinary communication as a didactic condition, and this condition of different authors is unequal. For example: interdisciplinary connections play the role of didactic conditions for improving the effectiveness of the educational process (F. P. Sokolova); interdisciplinary connections as a didactic condition that ensures consistent reflection of objective relationships acting in nature in the content of natural science disciplines in school (V.N.Sokolova) [17].

Several authors give definitions of interdisciplinary connections: "interdisciplinary connections, taking into account its logical structure, signs, concepts, are reflected in the course opened in the lessons of other disciplines" or " interdisciplinary connections are reflected in the content of academic disciplines of dialectical interconnections that have an objective impact in nature and are recognized by modern sciences. The definitions given above, of course, are correct, but they cannot be considered complete. In order to produce the most correct and informative definitions of the concept of" interdisciplinary connections", it is necessary to express it in another, even broader way. Such a broad definition of the category of interdisciplinary communication" is the concept of "inter-scientific communication", but "communication" is a derivative of the Universal. "Interdisciplinary connections" is primarily a pedagogical category and its binding, unifying function. In this regard, it is possible to make a definition: interdisciplinary connections are a pedagogical category for establishing analytical, integrative relationships between objects, phenomena and processes of real reality, which find their expression in the content, forms and methods of the educational process and perform educational, development and educational functions in a limited unity. The diversity of opinions about the pedagogical function of interdisciplinary connections is explained by their versatility in the actual educational process. At the same time, there is an insufficient

accounting of the relationship of pedagogy with other sciences. Now let's look at the classification of interdisciplinary connections, because, reflecting the laws of the development of classified concepts, it reveals in depth the connections between them, contributes to the creation of scientific and practical prerequisites for the implementation of these connections in the educational process.

In general, since the topic of our work is related to interdisciplinary communication, we cannot move away from the concept of "technology". Technology it was considered both from a pedagogical point of view and from the point of view of ICT. Now let's briefly focus on this technology.

In the Seventies, it was interpreted as the structure of interrelated processes in information processing using computer and software tools. In the Eighties, as a result of the development of computer systems and technology, the concepts of "teaching technology" and "pedagogical technology" began to be fully interpreted as a system of methods and tools for organizing and managing the educational process.

It is impossible to disagree with the possibility and necessity of the transition to the technologization of education in the age based on the achievements of science, since it is through this that the development of each child as an individual, the differentiation of education and the humanization and democratization of the entire education system is carried out. In this regard, modern pedagogical science is connected with the search for the goals of self-development and self-realization of the personality of the teacher and student through the technologization of the pedagogical process. In this regard, it is important not only to the modern school, but also to society, to consider what new models of education and training of the younger generation are in difficult socio- economic conditions, to systematically compare them and learn to find the right path. Teachers and methodologists, as well as psychologists and teachers, strive to answer these questions by emerging pedagogical technologies as a result of many years of pedagogical research.

These pedagogical technologies revolve around a single environment. He was a middle - aged man, and he was a good-natured man, and he was a good-natured man, and he was a good-natured man, and he was a good-natured man, and he was a good-natured man, and he was a good-natured man.

Today, many researchers are deeply interested in new technologies and consider the technological approach in education to be a much more effective new approach than the traditional one. In connection with this problem, since "educational technology", "pedagogical technology" are relatively new concepts that are entering scientific circulation, have a significant meaning, and various definitions are given to it. This concept was commented on by V.P.Bespalko, V.M.Monakhov, P.I.Pidkasisty, V.V.Gussev, Kazakhstan's scientists and other research scientists. As for the opinions of these research scientists:

V.P. Bespalko defined pedagogical technology as a set of tools and methods of Re-production, recall of theoretically justified processes of education and training that allow us to effectively implement the set educational goals. And V.M.Monakhov gave a different interpretation of this concept. He considered "pedagogical technology as a model of well - thought-out joint pedagogical activity to every detail of the design, organization and conduct of the educational process, which provides a favorable environment for the teacher and student. An important feature of teaching technology, according to P.I.Pidkasisty, is the continuous production of the learning cycle, that is, the "ability to repeat" it by any teacher and "feedback, objective control of knowledge". The technology of training is interpreted as a field, direction of scientific research on the development of production didactic processes with the characteristics of pre-assigned didactics and the definition of the principle and preparation of effective systems. And, according to V.V.Gussev, technology is a rule of Organization of activities and the choice of means for its implementation. Pointing out the difference in technology at the present stage from the previous one, V.V.Gussev

wrote: "previously, one tool could be assembled and used for several years in similar conditions. The very fact that there are similar situations now is contradictory." The results of the analysis of the comprehensive definitions of this technology show that most of them are presented in the form of a general conclusion, only relatively every aspect of the teacher's activity is studied, and the problem of forming a whole from the point of view of the student is not fully considered.

The law of the Republic of Kazakhstan "On Education" states that the main task of the education system is to create the necessary opportunities for obtaining knowledge aimed at the formation of a person and professional achievements on the basis of national and universal values, science and achievements, the introduction of new learning technologies, informatization of Education. In the formation of Kazakhstan as an independent state, the systemic reform of Secondary Education is of great importance from a public point of view. An important characteristic of the implementation of education reform is the need for modern technologization of the learning process. Therefore, recently, various new learning technologies have been considered and developed and introduced into school life. Let's look at the goals and principles of these new technologies. The goal of the new technology is to improve and humanize learning, that is, to ensure that teaching aids are able to conduct independent cognitive activities of students. Pedagogical principles of new technologies: a humane approach to the student; unity of teaching and upbringing; formation and development of cognitive, search-based strength of the student; mastering methods of independent interaction with the student; development of creative and cognitive flexibility of the student; training of each student according to their abilities and capabilities; systematic work for the proper development of all students; awareness of the educational process of the student.

Interdisciplinary connections are characterized primarily by their own structure, and since the internal structure of matter is an object, we can distinguish the following types of connections:

- by composition;
- in the direction of action;
- by the way the guide elements interact.

Thus, we analyzed in this section that ways to implement interdisciplinary communication in teaching mathematics in general education schools are implemented not only within a particular discipline, but also through several other disciplines.

1.3 Implementation of interdisciplinary communication through STEM teaching of mathematics in the context of updated educational content

STEM (Science, Technic, Engineering, Mathematics) is a new technology in education. Today, teachers, teachers and methodologists who use this method in the education system write down the effectiveness of the method in their articles. In the process of applying this method, the teacher acts in such a way that the students themselves accompany the work. The result of such a lesson is an assessment of students' own achievements in studying the topic and solving problems, as well as an assessment of their partners in the group. Students write their own opinion that the goal of this work is achieved for themselves and as a result of practice. The development of STEM is carried out on the principle of "from simple to complex". What are the results of using this method in a math lesson? First, there is an increase in the number of students who do not show high activity in the classroom, which indicates an increase in motivation to learn. Secondly, the most important thing is to improve the quality of knowledge on the studied topic. This means that the use of the STEM method in teaching mathematics has proven itself well and is ready for further development. Modern technologies in education require classes to be conducted in a playful, interactive way, as this directly contributes to improving the

motivation of students and the quality of their knowledge.

Stem-steam-stream is also one of the methods introduced along with updated educational content. One of these concepts is integration, the collection of several branches of knowledge that were previously divided into separate parts, and again making them common. Stem steam-stream is a research-based approach as a leading type of educational activity. It is based on problems, questions, tasks, and new concepts. In fact, stem - steam - stream approaches are easy to understand if they are used only in one aspect with school subjects, for example, in terms of the organization of learning and the content of educational activities.

This method has entered our education system along with the updated content of education, that is, the functioning of this method in secondary schools is carried out in accordance with the following regulatory documents (figure 3).

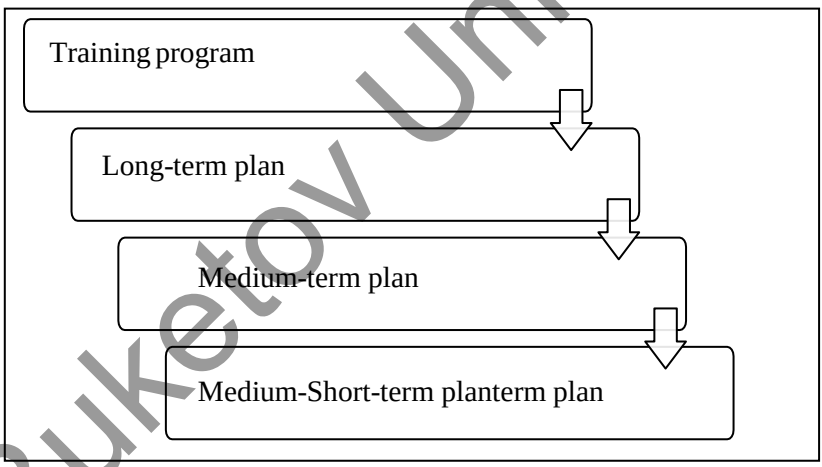

Figure 3. Documents on OSH

If we are looking for an answer to the question of what STEM education is, first of all we should make a small analysis of its

effectiveness, disadvantages, and prospects. Currently, the fourth technological revolution is taking place in the world: an intensive flow of Information, high-tech innovations and ready-made software products are changing all areas of our lives. Both the demands of society and the interests of the individual are changing.

It is impossible to become a comprehensive, competent specialist without mastering new learning technologies in the field of modern education. The acquisition of new technologies has an impact on the formation of intellectual, professional, moral, spiritual, civic and many other human forms of the teacher, contributes to self-development and effective organization of the educational process. This technology itself can be implemented by the teacher in different ways (moderately, carefully, accurately, or creatively). Here, the personal component, certain features of the technology practitioner are significantly affected, and at the same time, the main role is played by the actions of students – their perception, enthusiasm, and passion. In today's learning system, the use of various new methods is embedded in the practice and gives results. Learning technologies, new methods of teaching a person's cognitive abilities and cognitive processes: that is, various types of memory (es)

– hearing, vision, movement, etc. it is aimed at the development of thinking, motivation, perception of specially created educational and cognitive conditions, as well as the development of personal security, self - actualization, self-affirmation, communication, play, meeting cognitive and creative needs, and the development of an active vocabulary (in oral and written language).

Learning technology, that is, more broadly, pedagogical technology, is an important component of social technology, which, depending on the success of methods and means of processing, storing, transmitting information, can have all the opportunities for development. In the course of the formation and development of the concept of pedagogical technology, the essence of the concept of pedagogical technology is considered differently. The analysis of works devoted to the problem of pedagogical technology shows that

different views are expressed, from the concept of teaching technology with the help of technical means to the scientific understanding of pedagogical technology.

Learning technology is a system of methods, tools and types of learning that ensures the effectiveness of achieving the goals set for the implementation of the content of learning. In the technology of teaching lies the relationship and causality of content, methods and tools, in connection with which the ability to select the necessary content, effective methods and tools in accordance with the program and the set pedagogical task depends on the pedagogical skill of the teacher. Modern learning technologies are developmental, personality- oriented, purposeful technologies created on the basis of pedagogical and psychological teachings. The technology of the pedagogical process is a set of content, forms, methods, didactic requirements, psychological and pedagogical instructions of teaching, determined, selected and regulated in accordance with the requirements of the state in the field of education on the basis of a general methodology for determining goals and interests.

The technology of teaching is used in school as a systematic set of psychological activities, such as methods, methods, techniques, and didactic requirements necessary for the educational process. It has a positive impact on students ' discipline, motivation to learn, and educational activities, but also plays the main root of the educational process in such a way as to bring pedagogy closer to exact science, effectively affect the effectiveness and compactness of pedagogical practice, which is an intellectual and creative activity of teachers.

The same technology can be implemented in different ways, depending on the skill of the performers. As you know, more than 50 pedagogical technologies are currently used in the literature, which include trends and trends in the development of modern education. But teachers are not used to using it systematically in their practice and cannot distinguish it from the traditional methodology. Therefore, we analyzed some of them, indicating the criteria for choosing new learning technologies proposed by M. Potashnik, the

criteria of which are:

- requirements of the country, Region, City-Social demand for schools;

– state documents on the development of the school-state request;

- achievements and achievements of modern science about man;
- advanced pedagogical experience;
- work experience, creativity of teachers, school leaders;
- analysis of the work process and results of the school.

It follows that during the selection of pedagogical technologies:

- compliance of the acquired technology with the school's capabilities and real conditions;
- it turns out that regularity and efficiency, etc. should be taken into account. The basis of the currently used new pedagogical technology is:
- take into account the individual and individual characteristics of each student;
- improving the abilities and creativity of students;
- formation of students' skills of independent work, search.

Modern learning technologies in general:

- pedagogy of cooperation;
- humanization technology;
- game learning technology;
- problem-based learning technology;
- technology of training by reference signals;
- advanced learning technology;
- modular technology;
- technology of differentiated level training;
- technology of differentiated level training based on mandatory results.

In the course of the development of the field of education, the main task for the teacher is to train qualified specialists of their work in accordance with modern requirements. In the course of the rapid

development of informatization processes in society, it requires the formation of a versatile, well-versed personality in its activities of new technologies.

The main purpose of the process of teaching mathematics is the formation of students ' intelligence, creative thinking, scientific vision and activity, the development of skills of independent learning, systematic use of special pedagogical methods. This creates an opportunity to interest students. Their interest in mathematics is growing.

For the teacher, achieving the result is not only the student's knowledge, but also the ability to independently acquire knowledge and apply the acquired knowledge to the needs. Today's child is tomorrow's new world. Today, there is a huge flow of information. In order to work in the information environment, any teacher must be a teacher who has a developed communicative and Information Culture, who is able to masterfully combine traditional teaching methods in his business along with the methods contained in the content of the updated educational program.

If earlier Girls sewed aprons in labor lessons, and boys worked with wood or metal, then now this is not enough. Robotics, assembly, programming, modeling, 3D design and much more-all this now attracts modern schoolchildren from all over the world. To realize these interests, you need more complex skills and competencies. It is important not only to know and do, but also to research and invent. The main academic areas, such as science, mathematics, technology and engineering, should be developed simultaneously, which can be called STEM (science, technology, engineering and mathematics).

STEM is an integrated approach to learning, within which academic scientific and technical conclusions are studied in the context of real life. The goal of such an approach is to create a stable connection between school, society, work and the whole world, which contributes to the development of STEM literacy and competitiveness in the global economy [18].

The abbreviation "STEM" was first proposed in the 1990s by the American Bacteriologist R. Colwell, but it has been actively used since the 2000s. New versions of this concept have appeared on the basis of STEM. The most common are STEAM (science, technology, engineering, art, and mathematics) and STREM (science, technology, robotics, engineering, and mathematics). STEM is currently one of the main trends in global education. Thanks to the rapid development of technologies, new professions are emerging and the demand for specialists who have mastered STEM is growing massively. For example, in countries that are part of the euro Union, the share of specialists employed in this field increased by 12% from 2000 to 2013. In addition, in European countries, the demand for other specialties is projected to grow by 3% in 2025, while the demand for STEM specialists is projected to grow by 8%. Among the 16 OECD countries surveyed in 2011, Finland has the largest number of these graduates: this figure is twice as high as that of Canada and Switzerland.

In the field of STEM education is the basis for training specialists in the field of high technologies. Therefore, many countries, such as Australia, China, the United Kingdom, Israel, Korea, Singapore, and the United States, conduct government programs in the field of STEM education.

Now let's analyze the advantages of this method, that is, what is given priority. Advantages of STEM education: first of all, it is integrated learning in "subjects", not in subjects. STEM training includes an interdisciplinary and project-based approach. It is based on the integration of natural sciences, technology, engineering creativity and mathematics. A special feature of the curriculum is the refusal to study these disciplines individually without being related to other disciplines. Integrated learning of science, technology, engineering creativity and mathematics is very important, as these areas are closely intertwined in practice. And if we talk about the use of this method of scientific and technical knowledge in real life STEM education with the help of practical classes shows children

how to apply scientific and technical knowledge in real life. At each lesson, they design, prepare and develop products of modern industry. They will study a specific project, as a result of which they will create a real product with their own hands. For example, by assembling a rocket, young engineers get acquainted with concepts such as the engineering design process, launch angle, pressure, gravitational force, friction force, trajectory, and coordinate axes.

The development of critical thinking and problem-solving skills is also necessary for this method. STEM programs develop children's critical thinking and problem solving skills to overcome the challenges they may face in life. For example, students build high-speed cars and then test them. After the first Test, they wonder why their car did not reach the finish line and find out the reason. Maybe it was influenced by the design of the front part, the distance of the wheels, aerodynamics, or the starting Force? After each test, they continue to improve their design to achieve their goal [19].

This method is also characterized by increased self-confidence. Children will get closer to the goal by creating various products, building bridges and roads, launching airplanes and vehicles, testing (testing) robots and electronic games, developing their own underwater and aerial structures. They improve their product by improving it and testing it, improving it again and again. Students will finally achieve their goal by solving all the problems on their own. For children, this is joy, inspiration, and victory. After each victory, they become even more confident in their strength.

Active communication and teamwork are another thing that is being successfully implemented today in the context of the updated content of Education. STEM programs are also characterized by active communication and teamwork. At the discussion stage, a free environment is created for discussions and expressing their opinions. They feel so free that they even learn to speak and make presentations without being afraid to express any of their opinions. Children spend most of their time not sitting at their desks, but testing and developing their own designs. They constantly

communicate with instructors and their friends on the team. Children remember the lesson well when they are actively involved in the process [20].

We can also mention this method for developing interest in technical disciplines. The task of STEM teaching in primary school is to create initial conditions for developing students ' interest in natural science and technical subjects. Love for what he does is the basis for developing his interest. STEM classes are very fun and dynamic, so children will not get bored. They do not notice how time passes in the classroom and do not get tired at all. By building rockets, cars, bridges, skyscrapers, building their own electronic games, factories, logistics networks, and submarines, they are becoming more and more interested in science and Technology [21].

Now, from the point of view of the creative and innovative approaches used in the preparation of the project, STEM training consists of six stages:

- problem;
- discussion;
- design;
- Build/Build;
- testing;
- improvement.

These stages are the basis of a systematic project approach. Using all the different features in parallel or in combination, in turn, is the basis for creativity and innovation. Thus, through the simultaneous study and application of Science and technology, it is possible to create many new innovative projects [22].

Another aspect of this method is the 12-year education, which is being implemented in our country, that is, training and professional growth. There are many publications that analyze the level of growth of the need for different professions.

According to various forecast estimates, 9 out of 10 specialties that are in high demand will require STEM education. In particular, by 2018, the demand for chemical engineer, software developer,

petroleum engineer, computer network expert, Mechanical Engineer, Civil Engineer, Robotics, nuclear medicine engineer, underwater construction architect and aerospace engineer will grow [23].

Preparing children for technological innovations in life. STEM programs also prepare children for a technologically advanced world. Over the past 60 years, Technologies have evolved greatly: from the discovery of the Internet (1960), GPS technology (1978) to organ scanning (1984) and IPod (2001). Today, almost all people use iPhones and other smartphones. Today, it is impossible to imagine the world without technology. This means that technological development will continue, and STEM skills will be the basis for this development [24].

STEM is also considered an addition to the school curriculum. STEM programs for schoolchildren aged 7- 14 are designed to increase their interest in school activities. For example, in physics classes, students pass the Earth's gravity, write and explain formulas on the blackboard, and in STEM circles, they can consolidate their knowledge by building parachutes, rockets, or airplanes and launching them. For schoolchildren, it is sometimes difficult to understand terms that they do not see or hear. For example, an increase in pressure or volume due to an increase in temperature. In STEM classes, they can easily understand these terms by conducting interesting experiments. Therefore, high schools in the United States actively cooperate with STEM Centers. It is expected that the introduction of STEM education in schools will contribute to finding solutions to the problem of training good engineers in the future.

STEM technology capabilities:

1. funding for STEM education is being strengthened: an increasing number of various non-profit organizations are providing grants to schools for the implementation of technology-oriented projects.

2. STEM — a wide range of professional development opportunities.

3. provide students with access to technology. The world is

built on massive computer networks, and now children create, exchange and use digital content on a wide scale. They open websites, shoot movies on their phone, and create their own games.

4. STEM technologies mean creating a learning environment that promotes maximum student engagement. In any case, the students are interested in their own learning. Students will be able to remember what they learned better if they are absorbed and actively participate in the learning process.

5. STEM technologies require students to have critical thinking skills, skills to work independently and in a team [25].

Disadvantages of STEM technology:

1. Low communication skills, especially vocal skills. In STEM technology, engineers focus on formulas, equations, and material structures written in book Language.

2. STEM often focuses on engineering, so students may lose their creative skills.

3. for engineers who are well versed in operating systems and techniques, solving simple "everyday life" problems can be difficult.

4. fragmentation of students ' knowledge as a result of specialization of teachers in a narrow circle. This direction can only be carried out by teachers who have received additional professional training and are ready to work in a single system of natural science disciplines and technologies [26].

If we are looking for an answer to the question of the conditions for implementing STEM technology, that is, why it is introduced:

1. it is necessary to create an extensive system of search, support and support of talented children.

2. it is necessary to develop a creative environment for identifying gifted children in each general education school. It is necessary to provide high school students with the opportunity to study in correspondence, full-time and distance learning schools, which will create conditions for mastering specialized training programs.

3. it is necessary to develop an established system of support

for talented (gifted) children. It is advisable to extend the experience of physical and mathematical schools and boarding schools at a number of universities in the country.

4. work with gifted children should be economically feasible. The standard of per capita financing should be determined in accordance with the characteristics of not only the educational institution, but also students. A teacher who causes a student to achieve high results should receive significant incentive payments [27].

STEM education is actively developing in Kazakhstan. Within the framework of the state program for the development of Education and Science for 2016-2019, updated educational content in the text of STEM training has been introduced in schools of the Republic. To implement the new educational policy, it is planned to introduce STEM elements in the curriculum aimed at developing new technologies, scientific innovations, and mathematical modeling.

A new interdisciplinary and project approach to teaching has been introduced. It contributes to strengthening the research and scientific and technological potential of students, developing critical thinking, innovative and creative thinking, problem solving, communication and teamwork skills. The number of "common topics" between subjects of the natural and mathematical direction has increased. Since the 2015-2016 academic year, first-graders have started studying the subject "Natural Science", which is the basis for studying Natural Sciences in high school. In addition, since the 2016-2017 academic year, it is planned to equip all schools with ICT, digital educational resources, and internet access. At the same time, in high schools, subjects of the natural and mathematical direction are taught in English, which will contribute to learning new knowledge in the original language and joining the world scientific community [28].

In the context of the new standard, the organization of training is also changing in many ways. The main feature of the updated content of education is intrasubject integration through cross-cutting

topics. The integration process is a high form of implementation of inter-subject relations at a qualitatively new stage of training. Integration in education is the implementation by a student, under the guidance of a teacher, of a consistent translation of messages from one educational language to another, the assimilation of knowledge, the regulation of concepts, the birth of personal and cultural meanings. Integration has great potential opportunities in the development of the child's intelligence, which are not used enough in traditional education. The integration of knowledge from various subjects is carried out through an integrated lesson. Integrated lesson - a lesson in which the material of several subjects is combined around one topic. Integrated lessons contribute to the formation of a holistic picture of the world in children, understanding the connections between phenomena in nature, society and the world as a whole. Such lessons help to develop imaginative thinking, creative and cognitive activity, increase educational motivation, relieve fatigue and overstrain of students by switching from one type of activity to another. An integrated lesson is built on the basis of a single subject, which is the main one. It involves the possibility of involving each student in an active cognitive process. Each student has the opportunity to prove himself in the field that is closer to him and to put into practice the knowledge gained. Thus, in the framework of updated education, we analyzed STEM education, one of the methods of implementing interdisciplinary communication in teaching mathematics, which is not very popular in our country, but is widely practiced in a number of countries around the world.

II IMPLEMENTATION OF INTERDISCIPLINARY COMMUNICATION IN THE METHODOLOGY OF TEACHING TOPICS ON EQUATIONS AND INEQUALITIES IN ALGEBRA COURSE AT HIGH SCHOOL

2.1 The importance and place of "interdisciplinary communication" in the process of teaching Algebra

The computer should be used at all stages of the educational process: when explaining, fixing, repeating a new lesson, checking knowledge, skills, checking progress and improving students' knowledge. The use of information technologies will help, firstly, to increase the productivity of the teacher and to devote more time to checking the results of learning; secondly, to assess the knowledge gained by children with objective monitoring; thirdly, to introduce scientific elements into the control technology, which can serve as a basis for talking about technologies of standardization of the level of knowledge and skills acquired in educational institutions, so it can be used in the future. It is proven that the computer, special programs as an auxiliary tool of the teacher, increase the effectiveness of the lesson. Also, when conducting a computer lesson, it is possible to give each student tasks of different levels, show graphs from different angles, and take into account and monitor the indicators of knowledge of students in groups. At the present stage, the theory of textbooks, design methods of teaching with new information technologies are being developed. Computerization of the learning process causes teachers ' interest, creative search and desire to master the methods of their application in practice. In his report, Elbasy N.A.Nazarbayev noted that "those who work and live in the future are today's schoolchildren, and Kazakhstan will be at the same level as the teacher educates them. Therefore, the task assigned to the teacher is heavy". A modern teacher requires not only deep knowledge of his subject, but also historical cognitive, pedagogical

and psychological literacy, political and economic knowledge and information literacy. A special feature of the modern education system is the need not only to equip themselves with knowledge, but also to develop self – education, creating a need for continuous self-development. We believe that improving the level of education in schools and improving the educational process through the use of Information Technologies is a systematic direction of teachers and managers of the teaching staff.

"Including the integration of topics in mathematics» the new methodological system of teaching mathematics, one of the most effective ways to teach subjects in schools, is to activate students' activities and increase their desire to learn. In this context, attention is paid to the organization of education in the main school, improving the level of educational work and increasing its prestige. Currently, one of the most difficult tasks is to study effective teaching methods and recommend them for practical use in ic. Mathematics and physics, taught in the main school, are of great importance in familiarizing students with objects and phenomena of the environment, systematizing scientific ideas about them, and forming their vision. There are many types of teaching methods in basic educational institutions. One of them is teaching mathematics based on the integration of educational topics. In order to fully express mathematical terms, rules, definitions and theorems, to be mathematically competent, of course, each topic must be absorbed by the student, reached his consciousness, and mastered. In each lesson conducted with these tasks, the rational use of the integration of educational topics will always bring results. An important type of educational activity in the process of developing students' creative abilities and thinking independence in mastering mathematical theory is the process of performing mathematical exercises. One of the goals of today's school is to educate the generation of a fully harmonious, civilized country. This goal requires every school teacher to gradually improve the teaching methods that meet modern requirements. Compliance with this requirement is achieved only

when each topic of each chapter of each subject in the school curriculum is studied in such a way that it reaches the student's consciousness. In this case, mathematics also has a great role in educating students as individuals. At the moment, a mathematics teacher should first of all have creative scientific thinking and knowledge in their specialty. The applied meaning of mathematical results plays a major role in educating students ' scientific point of view. Equations and inequalities and related to the wide application of their systems, they form a necessary part of the school mathematics course in various fields of mathematics, in solving important applied problems.

Teaching equations and inequalities is different in textbooks. To reveal the content of equations and inequalities, you can consider the following two ways.

1. First, the relevant materials for equations and their systems are studied, and then inequalities are studied.
2. First, groups of equations and their systems are studied, and then groups of inequalities are studied.

In the school mathematics course, equations and inequalities and materials related to their systems form the main part of mathematics. Because equations, inequalities, and their systems are widely used in every section of mathematics and in solving important applied problems. In this regard, the problem of mastering the directions of building equations, the connection of the network of inequalities with applied, theoretical and mathematical networks in the school is closely related to the problem of analysis and qualitative assimilation of materials for teaching solving equations and inequalities.

If we look at history, the beginning of algebraic methods of solving practical problems from the history of mathematics connected with the world of ancient science, Egyptian and Babylonian mathematical solutions formed a significant part of mathematics, but over time various problems arose. Here were the conditions of some quantities, the equations required by modern

approaches, and their systems. Even then, problems began to appear that required the creation of equations and inequalities. Initially, arithmetic methods were used to solve such problems. Then the formation of the algebraic method began. Detailed historical information is given in the methodological guide. This study continued in the next era, when Arab mathematicians brought equations to the standard form, and then European mathematicians, almost a century later, showed the modern language of Algebra (the use of letters, the presence of symbols in arithmetic operations, parentheses, etc.).

The theory of equations and inequalities is the main educational material of scientific and pedagogical significance, so that students can develop logical thinking in high school, it will teach students to think clearly, correctly, and compare quantities. Therefore, in the process of creating a report, it is important to develop creative abilities and search qualities in various ways, choose the simplest and most effective ones. Despite many good developments in school mathematics recently, students ' understanding of inequality has declined. To eliminate this gap, it is necessary to improve the theory of inequality and the way it is studied. Solving equations and inequalities should be linked to the evidence around them that we encounter on a daily basis. To this day, in the development of equations and inequalities, it is possible to note the change and renewal of various methods, the concretization of concepts and the connection with other sections of mathematics. The essence of equations and inequalities in the system of algebraic concepts plays an important role in this process. In the development of Algebra, the basis of an equation as a concept is based on three bases:

a) equations as a means of solving text problems;

b) equations as a unique formula that can be an object of study in algebra;

c) equations as a formula that defines the coordinates or numbers of points in space (plane).

Considering the importance and breadth of the equation

associated with the concept of an equation, its study is organized on a content-methodological basis in modern mathematical methods. Here, the study of equations and inequalities in a school mathematics course, the relationship between them, general and individual methods for their effective solution, is considered to clarify the formation of a network of equations and inequalities. Equations and inequalities are also closely related to functional areas. The most important of these relations is the methods of constructing equations for the study of functions. On the one hand, the functional orientation also somewhat contributes to the content of the network of equations and inequalities and the type of study of them. In principle, the functional orientation of solving equations and inequalities by studying them requires graphical visualization. In people's daily lives, inequalities become more necessary than equalities.

Among the fundamental goals set when transferring methods for solving equations and inequalities and their systems in school algebra is the problem of developing skills and abilities for effective problem solving. Due to the complexity and complexity of the problem, it has not yet been able to find the final scientific and methodological solutions. In this regard, it is necessary to use teaching methods using various special programs in teaching solving equations and inequalities in secondary schools. One of the main forms of their development is the formation of skills to refine theoretical knowledge and apply it in practice.

An equation is used to study the exact solution of a trend, and an inequality is used to study the movement of a certain interval. In order to assess the level of consistency and complexity of mathematical knowledge when teaching mathematics in high school, it is necessary to rely on the ability of students to freely choose teaching methods for solving equations and inequalities, the ability to consider the simplest and most convenient situation in ic in the form of a mathematical model, the ability to use mathematical methods for solving complex problems. In teaching mathematics, not only does it teach you how to solve equations and inequalities, it plays an

important role in solving any problem, overcoming difficulties, improving cognitive and thinking abilities.

The school curriculum includes a wide range of topics from equations and inequalities to the theory and practical problems of solving high-order equations and inequalities and their systems. For example, problems such as solving linear inequalities, studying quadratic triples using second-degree inequalities, analyzing equations, approximate calculations, irrational number theory, and numerical series are explained by inequalities. Continuous processes of nature, especially economic, environmental, etc., are studied not only in mathematics, but also in various natural sciences. connections in industries are solved using inequalities.

Equations are created by inequalities, which can be called an independent type of inequality. To convert inequality to equality, it is necessary to accurately estimate the difference of two values. It is necessary to teach students to judge the conditions for preserving the power of inequality, to distinguish possible values of unknowns so that the inequality does not disappear. The school mathematics course presents three main areas of separation of equations and inequalities and writing functional concepts.

a) application direction: the main method of teaching equations and inequalities in meaningful problems. This method is widely used in school mathematics courses, as it is used in mathematics applications related to teaching methods;

b) the theoretical and mathematical direction is expressed in two aspects of equations and inequalities: first, in the training of the main classes of equations, inequalities and their systems, and secondly, in the training of general concepts and methods related to equations, inequalities and their systems.

c) description of equations and inequalities related to the content of other mathematics courses. These are systematic numerical equations, inequalities, and are closely related to their systems. The main idea is to implement the main process of this sequence, the idea of which is an extension of the numerical system.

All numerical areas in the school textbook algebra and algebra and analysis, equations, inequalities and their systems are used in the field of real numbers in relation to any solution.

In the publications of the journal" mathematics and physics K.K. Akhmetova "Formation of skills of proving mathematical in equalities" [29], M.Kabasov " Solving some systems of equations "[30], E.Medeuov "Methods of proving inequalities" [31]. Extensive analysis of these topics in publications will be an indispensable tool for school teachers in the exchange of methods.

Let's show how the topics of equations, inequalities and their systems are described and analyzed in school textbooks.

Now let's analyze the teaching of equations, inequalities and their systems in the 8th grade. In the textbook of Algebra reading for the 8th grade, the authors of which are B. Baimukhanov, E. Medeuov, K. Bazarov, the topic "quadratic equation" is considered in Chapter II. According to the program, 22 hours of reading quadratic equations are allocated in the II-III quarters. The main purpose of this section is to develop the ability to solve quadratic equations and simple rational equations and their application in solving problems [32].

All material is divided into three sections. Chapter II consists of 5 paragraphs.

- definition of a quadratic equation. Solving a quadratic equation.
- fractional-rational equations
- properties of roots of a quadratic equation. Vieta's theorem.
- square three-dimensional.
- some types of equations that can be converted to a quadratic equation.

The main goal is to introduce the concept of a quadratic equation, introduce the algorithm for solving an incomplete quadratic equation and the corresponding terms. Learning the concept of a quadratic equation begins with the introduction of its definition by the real – inductive method. An incomplete quadratic equation is

defined in an fuzzy form and its solution algorithm:

1) $ax^2 + c = 0, c \neq 0$

2) $ax^2 + bx = 0$

3) $ax^2 = 0$

The materials in this point are focused on the following:

- knowledge of the definition of a quadratic equation;
- be able to name coefficients of a quadratic equation;
- knowledge of the definition of an incomplete quadratic equation;
- develop skills and abilities to solve incomplete quadratic equations in all three forms (problems are gradually becoming more difficult).

The concept of a quadratic equation given in the next paragraph is introduced. Then we consider solving quadratic equations by dividing the square of two members.

The material is aimed at the direct application of these methods to solve the problem.

"Formula for the roots of a quadratic equation". The main goal is to teach students how to solve quadratic equations in a formula and introduce them to the application of the Vieta's theorem and the inverse theorem to it.

In the first point, the formula of the roots of the general quadratic equation and the formula of the roots of the second quadratic equation, the coefficient of which is an even number, are summarized. The output of the formula is prepared with the previous point. Various possible situations that depend on the discriminate are considered ($D>0$, $D=0$, $D<0$). Finally, an algorithm for solving a quadratic equation is given. In the last point of the topic, Vieta's theorem for a quadratic equation is shown, which proves the opposite statement. The use of these methods is considered in the examples.

The point contains a lot of exercises on the application of two theorems in different situations. There are also problems with parameter equations. Additional exercises are distinguished by their

complexity.

"Fractional rational equations". The main goal is to form the ability to solve fractional rational equations and apply them in the process of solving problems.

The item "solving fractional rational equations" begins with the introduction of the concept of rational, integer, fractional equations, considers the method of solving a rational equation, and then gives the solution algorithm. Exercises at the point are given for the formation of skills and abilities to solve rational equations.

The second point is devoted to solving problems using rational equations. You can specify three types of reports within the exercise:

1) problems with an oral description of the equation;
2) calculations for smooth movement;
3) reports on "combined work". Additional reports are more complex.

Logical analysis of the topic allows us to highlight the "nuclear" material:

- concepts of square equation, incomplete square equation, given Square equation, fractional rational equation;
- algorithm for solving an incomplete quadratic equation;
- ways to solve a quadratic equation:

a) distinguish the square of two values;
b) formula for the roots of a quadratic equation;
c) Vieta's theorem, the inverse theorem to it;

- algorithm for solving a fractional rational equation;
- application of quadratic equations, fractional rational equations in solving problems.

Taking into account the above, the following learning problems are posed: formulation of general and specific learning methods for solving quadratic equations, simple rational equations; formulation of the ability to solve problems using quadratic equations, simple rational equations.

To solve these problems, the following training tasks are set::

- introduction of the concepts of square equation, incomplete

square equation, given Square equation, fractional rational equation;

- solving an algorithm for solving an incomplete quadratic equation;
- determination of ways to solve a quadratic equation;
- To reveal the significance of Vieta's theorem;
- determination of the dependence of the number of roots of a quadratic equation on the discriminant;
- creating an algorithm for solving a fractional rational equation;
- formulate the skills of constructing an equation based on the problem condition;
- develop the ability to verify the compliance of the found solution with the accounting conditions.

The educational task" introduction of the concept of a quadratic equation "was completed by students independently working with the text in the textbook and asking the question:" what equation do we call a quadratic equation? Why? it is possible to answer the following questions:

Chapter III. Quadratic inequality.

To study the topic "quadratic inequality" in this textbook, the program takes 19 hours. The main goal is to develop the ability to solve linear inequalities with a single variable and their systems.

In the textbook, the topic" quadratic inequality " consists of 5 paragraphs:

- a system of linear inequalities with one variable;
- equations and inequalities with variables obtained under the module sign;
- quadratic inequality;
- interval method for solving inequalities;
- discriminate.

The presentation of the material begins with the definition of the concepts of "big" and "small" in the item "quantitative inequalities". The introduced definitions will serve as reference concepts for proving the property of numerical inequalities.

"Nuclear" material of the topic:

- concepts of "big", "small", "inequality";
- properties of numerical inequalities;
- performing operations on numerical inequalities is considered to be;

The presentation of the material is based on algebraic operations, equal transformation, the concept of coordinate straightness, and the law of arithmetic operations. The system of exercises in this paragraph can be divided into the following groups:

- approval of the definition of" large "and" small " concepts;
- to prove inequalities;
- to study the truth of inequality;
- compare numbers using a geometric representation;
- fixing the properties of numerical inequalities;
- evaluate the value of the expression;

The main problems of learning quantitative inequalities and their properties are considered to be: the formulation of general and specific learning methods for proving unconditional inequalities.

Presentation of the material is carried out by oral and informational method.

The training" inequalities with a system of linear inequalities of one variable and their systems "begins with the point" number intervals". Here we introduce the concept of" number interval", its various designations depending on the severity of the inequality.

In the item" solving an inequality with one variable", a definition of solving an inequality is given. The algorithm for solving a linear inequality is similar to the algorithm for solving an equation. Then the concept of

a linear equation with a single variable is introduced and $a \neq 0$, given in specific examples.

The material problem can be classified as follows:

- interval training;
- issuing a certificate of the number lying in the interval;
- find the connection and intersection of intervals;

- consolidation of the concept of" solving inequality";
- $ax < b, ax > b$ the solution of inequalities is develop skills in solving linear inequalities with a single variable;
- illustration to the definition of solving systems-exercises;
- exercises to develop the ability to choose the interval at which the solution of the inequality system will take place;
- exercises for a system of three inequalities.

When teaching the topic" linear inequalities and their systems", students are faced with a problem: inequalities and learning to solve their systems.

This problem can be solved through the following tasks::

- determining the transfer of a digital interval from one "language" to another;
- disclosure of the algorithm for solving inequalities;
- disclosure of the algorithm for solving the inequality system. "Nuclear" material of the topic:
- solving inequalities, systems of inequalities;
- inequalities and algorithms for solving their systems.

In the textbook "Algebra" for the 9th grade by the author A. N. Shynybekov, our topic begins with Chapter I "nonlinear equations with two variables, inequalities and their systems" [33].

§1. nonlinear equations with two variables and their geometric meaning

- equations with two variables
- geometric meaning of equations with two variables

§4. solving a system of inequalities with one variable

The concept of solving inequalities. Solving a system of inequalities with a single variable

According to the program, 15 hours are sent to study equations and their systems in the 9th grade in the second quarter. This interval includes Chapter II: §5 "equations with one variable". §6" systems of equations with two variables " are given for reading.

The main goal is to generalize and systematize information about Integer equations, formulate the ability to solve equations with

letter coefficients, demonstrate the ability to solve equations graphically, form the ability to solve systems of equations of the second degree and solve text problems by compiling a system of equations.

At the first point, students activate their knowledge of integer equations. Examples are considered, in each of which transformations are made that are brought to an equation related to the given equation. The result $P(x) = 0$ is a polynomial of the type, where $P(x)$ is the standard polynomial. Examples show that the roots of the equation do not exceed its degree. In general n – the number of roots of the degree equation is no more than n .

The following item provides examples of how to solve an equation of the 4th degree using the introduction of a new variable. This is where the concept of biquadrate is introduced.

The exercises are aimed at solving equations using the introduction of new variables, skills and abilities to solve biquadrates equations. Among the equations, there are equations of the 5th degree, the use of which is necessary when solving the classification of multipliers and the introduction of new variables.

The next point deals with equations and graphs with two variables; a graphical approach to solving a system of equations, solving a system of equations of the second degree, is considered. The concept of the degree of an equation with two variables is introduced by the method of analogy.

In the item" solving a system of equations of the second degree", an algorithm for solving a system of equations using the substitution method is given. Its use is shown in the example of solving two systems: one consists of equations of the first and second degree, and the other – of the second degree in both. Exercises are often given to a system of equations in which only one equation is of the second degree. Among them, there are systems in an inconspicuous form. All tasks have two systems of equations of the second degree. In additional exercises, there are many systems of equations, and the choice of how to solve them is given to the student

himself.

The topic ends with the item" solving problems using a system of equations of the second degree". Here the reports can be distinguished as follows:

- geometric problems;
- reports for work;
- traffic reports.

The logical and mathematical analysis of the topic shows the following "nuclear" material:

- the concept of integer, biquadratic equations;
- the concept of the degree of equations with an integer and two variables;
- solving equations by classifying them into multipliers, graphically, and quadratic;
- solving a system of second-degree equations by graphical method, addition method, and substitution method;
- solving problems with a system of equations of the second degree.

The presentation of the material is based on solving linear and quadratic equations, performing equal transformations of polynomials, reading and constructing graphs of functions.

In this regard, students are faced with the following problems: equations of the second degree, the formation of skills and abilities to solve systems of equations and solve problems through them.

These problems are solved using the following tasks:

- activation of the concepts of "integer equation", "degree of equation";
- introduction of the concept of" equations with two variables";
- $p(x) = 0$ output of an algorithm for solving an equation in the form of polynomial $p(x)$;
- development of an algorithm for solving an equation using a graph;
- output of an algorithm for solving an equation using the

input method of any variable;

- introduction of the concept of the biquadratic equation;
- development of an algorithm for solving a system of equations using a graph;
- output of an algorithm for solving an equation by adding. Learning a square inequality with a single variable.

In the 9th grade algebra course, 8 hours of training on the topic "inequalities" are provided by the textbook program.

The main goal is to develop the ability to solve inequalities based on the property of a square function $ax^2 + bx + c > 0$, $ax^2 + bx + c < 0$; to solve inequalities by the method of intervals.

The last paragraph of the chapter" inequality with one variable "is devoted to a quadratic function and consists of two points:" solving a second-degree inequality with one variable", "solving inequalities by the interval method". At the first point, the presentation of the theoretical material begins with the introduction of the concept of a second-degree inequality with a single variable. Its solution is considered as finding intervals in which the corresponding quadratic function takes either positive or negative values. Following the examples, $ax^2 + bx + c > 0$, $ax^2 + bx + c < 0$ an algorithm for solving an inequality of the form is given. The material of the report is aimed at developing skills in solving inequality. Exercises are distinguished by the difficulty of equal transformation. To find the area of definition of a function, there are reports of inequalities that are given in an implicit form.

In the next paragraph $(x - x_1)(x - x_2)...(x - x_n) > 0$, $(x - x_1)(x - x_2)...(x - x_n) < 0$ solve inequalities of the form is generalized and inductively introduced by the property of exchange. On the basis of this property, examples of inequalities solved by the interval method are shown. Point exercises are widely used to form the ability to solve inequalities using the interval method.

The "nuclear" material of this paragraph:

- second-degree inequalities with one variable;
- solving inequalities based on the graph of a quadratic function $ax^2 + ba + c > 0$, $ax^2 + ba + c < 0$;
- solving inequalities using the interval method.

Teaching equations, inequalities and their systems in the 10th grade. In school textbooks, the topics of trigonometric equations, inequalities and their systems are taught in various schemes. In the textbook of A.N Kolmogorov grades 10-11 "algebra and the beginnings of analysis", the fifth paragraph of the first chapter is taught using the following system:

Solving trigonometric equations and inequalities:

- arcsine, arccosine and arctangents;
- solving simple trigonometric equations;
- solving simple trigonometric inequalities [34].

Equations formed from trigonometric expressions are called trigonometric equations. The system of exercises is divided into levels A,B, and C. There are 6 reports for level a, 7 reports for Level B, and 2 reports for Level C. Mixed reports are divided into levels B and C, and 5 reports are provided for each level.

Inequalities formed by trigonometric expressions are called trigonometric inequalities. The introduction of the concept in this topic is given in an abstract-deductive way. The system of exercises is divided into levels A,B, and C.

Teaching equations, inequalities and their systems in the 11th grade. The introduction of the concept is given in an abstract-inductive way. 4 examples of the simplest type of exponential equation are considered. Examples have gone from simple to complex. The definition of the general exponential equation is not given. Point 2 of paragraph provides for exponential equations and inequalities. He solved simple exponential inequalities using several examples. The exercise system contains 15 reports. A system of exercises that are similar to the tasks shown in the example.

2.2 Traditional methods of teaching equations and inequalities and ways to implement interdisciplinary communication

The main didactic principles that guide the teaching of mathematics, as well as other natural science disciplines, are as follows:

1. The principle of Science. It is a qualitative indicator of the satisfaction of the following three characteristics of the scientific nature of knowledge:

a) the content of education corresponds to the level of modern science;

b) ensuring students' confidence in the correctness of the general method of cognition;

c) demonstrate the most important patterns of the cognitive process;

These stated conditions are closely related to each other and are considered a necessary condition for each of the previous ones. The first condition requires a scientific presentation of mathematical materials.

The second condition is that the scientific principle of learning requires knowledge of scientific knowledge.

This is only a necessary condition for the science of knowledge.

The third condition requires students to develop their own ideas about the process of cognition and its laws.

In order to implement these conditions, the teacher should make extensive use of problem-based learning and various research methods in the learning process.

2. The principle of education in the learning process. The teaching of mathematics is not carried out independently, but obliges students to perform the function of comprehensive education in parallel.

3. The principle of visibility in teaching mathematics. It

follows from the essence of the process of perception, analysis and generalization of students ' educational material. This method has been an integral part of the methodology of teaching school mathematics for many years and will continue to be a trend.

4. The principle of consciousness and activity in teaching mathematics. This principle follows from the tasks and goals of the school for the training of active and conscious people of modern society and from the peculiarities of the learning process itself, which requires a meaningful and creative approach to the assimilation of mathematical material.

5. The principle of strength of knowledge in teaching mathematics. In order for students to have strong knowledge and skills in teaching mathematics:

a) it is necessary to be able to organize the repetition of the passed material in a qualified manner (repetition before passing new topics, repetition during the passage, final repetition, etc.);

b) monitor students ' knowledge and skills in a timely manner and anticipate and correct gaps that occur here;

c) students should pay special attention to the regularity (not the same way) of tasks, exercises, and other tasks, etc.

6. The principle of consistency and consistency in teaching mathematics. Regularity in teaching mathematics

- involves maintaining a certain order in the study of data and gradually mastering the basic concepts and principles in the school mathematics course. Learning on the principle of sequence (gradual uniformity) in teaching mathematics:

A) from simple to complex;

B) from the illusion to the concept;

C) from the known to the unknown;

D) move in the direction of transition from knowledge to skills, from skills to skills.

To implement this principle, the teacher must place the teaching of mathematics in the form of a sequence of steps, the next step complements the knowledge, skills of the first step and serves as the

basis for the ascent of students to a new stage of knowledge.

7. The principle of comprehensibility in teaching mathematics. Understanding in mathematics cannot be understood as the maximum simplification of Education. The didactic essence of understanding is that the student is taught according to his age, and the knowledge provided should not be too difficult or too easy. Didactic principles are closely intertwined and form a single system [35].

When we talk about methods of teaching mathematics and their classification, we will first focus on the "methodology".

Method (from the Greek "methodos – method of research") is a way to achieve a goal. The teaching method refers to an ordered set of didactic methods and tools used to achieve the goals of learning and education (figure 4).

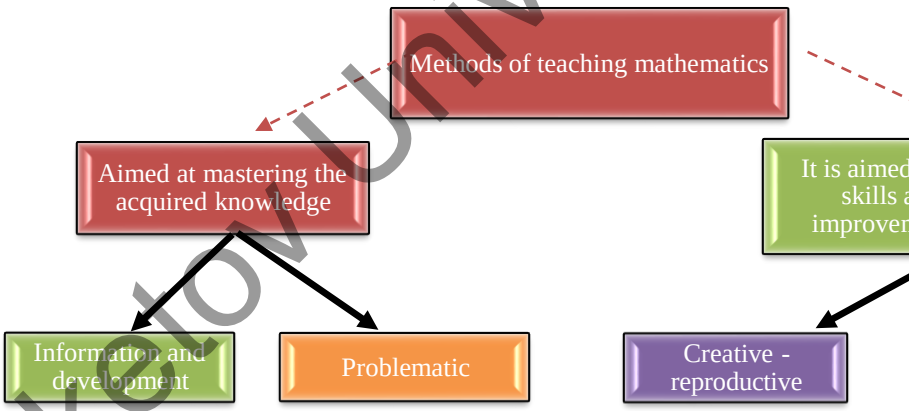

Figure 4. Methods of teaching mathematics

Since the teaching method involves interrelated, sequential approaches to the targeted activities of the teacher and students, any teaching method has a purpose, a system of services, learning tools and a fixed result. The object and subject of the teaching method is

the student. The teacher usually uses various methods in the learning process. And any single method, planned in its pure form, can only be used for special or research purposes.

Today, there are various foundations for the theory of modern teaching methods:

1) by the nature of cognitive activity:

- explanatory and illustrative (conversation, lecture, narrative, demonstration, etc);
- reproductive (solving problems, repeating experiences, etc.);
- problematic (problem reports, cognitive reports, etc.).);
- heuristic (partial search); "research.

2) by service components (components) :

Didactic principles, observed system, and types of training are considered.

- methods of organizing and implementing organizational-activity – educational-cognitive activities;

-methods of motivating and motivating educational and cognitive activities;

- Observer-evaluator-methods of monitoring and evaluating the effectiveness of educational and cognitive activities.

3) for didactic purposes:

- methods of learning new knowledge;
- methods of consolidation of knowledge;
- control methods.

4) methods of presentation of educational material:

- monologue-informational-communicative(conversation, lecture, explanation);
- dialogic (problem narration, conversation, discussion).

5) on the forms of Organization of educational activities;

6) by the level of independent activity of students;

7) by educational sources:

- oral (conversation, lecture, conversation, instruction, discussion);

- visual (demonstration, illustration, drawing, demonstration of material, etc);
- practical (training, laboratory work, workshop).

8) accounting for the structure of the individual:

- consciousness (consciousness, thought) (conversation, conversation, instruction, example);
- behavior (face away, direction) (exercise, training);
- motivation-feeling (support, praise, control, etc.) [36].

The above classification is considered in the didactic aspect. Choosing a teaching method for each topic is a creative work, although it is based on the theory of general learning. Teaching methods cannot be divided, universalized, or divided into one. In general, depending on the application situation, one method may be effective or ineffective. Over time, the content of education gives rise to new methods of teaching mathematics. The second chapter of the master's thesis describes in detail about new methods, namely the use of information technologies and special programs.

Pedagogical classification of teaching methods is divided into teaching methods (teacher activity) and teaching methods (student activity). Teaching methods include the teacher's advice, conversation, means and methods of communication, methods of organizing and evaluating students ' cognitive activities. Teaching methods include methods, means and methods of mastering educational material, reproductive and productive learning methods, and self-control. The main methods of current mathematical research include observation and experience, comparison, analysis and synthesis, generalization and refinement, and abstraction. And modern methods of teaching mathematics:

- problematic (promising);
- laboratory;
- programming training;
- heuristic;
- creating mathematical models;
- axiomatic, etc.

Now let's focus on the classification of teaching methods used by teachers, which are divided into: aimed at the initial acquisition of knowledge (informational-developmental; problem-search); aimed at the full improvement of knowledge and the formation of business and skills (reproductive; creative-reproductive).

The information and development method, in turn, is divided into two classes:

1. providing information in a ready-made form (lecture, explanation, reading, showing movies, videos, listening to magnetic tape);

2. independent acquisition of knowledge (independent work with books, working with educational programs, Information Technology).

Problem-search methods are divided into: problem-based presentation of educational material(heuristic conversation); laboratory search work; research work, etc.

Reproductive methods: presentation of educational material; performing exercises according to the sample; laboratory work on instructions.

Creative and reproductive methods: works; variational exercises, etc. In order to successfully use a particular method or a particular form of learning in the process of teaching mathematics, the teacher must have a good knowledge of these methods. The essence of this is that:

a) it is necessary to understand the essence of this method and be able to apply it in various specific learning situations;

b) it is necessary to know the most common forms of each method in the learning process;

c) it is necessary to know the observed, encountered, pros and cons of this method;

d) it is necessary to know in advance what problem;

e) the ability to teach students to work with this method in the process of learning the teaching methodology.

Since the first chapter of our research is devoted to theoretical

analysis, we consider the traditional methods of teaching in secondary schools. Traditional methods include, first of all, dogmatic methods of word presentation and interpretation of finished knowledge (teacher's story and lecture). In these methods, the active role is played by the teacher, and the task of the listener remains for the students. The methods of teaching mathematics currently have the task of making significant changes and innovations in the relationship between the teacher and the student during conversations and lectures. The main goal here is to raise students to the rank of not only an inactive listener, a receptionist, a simple performer, but also an active performer of mental activity, so the teacher's educational conversation and lecture should not leave students indifferent, but actively attract them to the facts, facts, and news. This significance was described in the introduction of the dissertation work with reference to state regulatory documents.

One of the most commonly used methods in mathematics is practical and laboratory work. Various practical and laboratory works are of considerable importance in the study of mathematics. The ancient forms of them, which have long been used in school, include drawing exercises, Earth measurements, modeling, working with computer equipment, etc. Laboratory work is divided into cognitive and applied works, depending on their intended purpose. Cognitive laboratory work is used to introduce students to new mathematical data. In applied laboratory work, students learn to apply their acquired mathematical knowledge to solving specific practical problems. In the course of practical work, materials are sometimes collected to create and solve specific problems that have an industrial or other life-practical significance with a visit to a specific object. Such works can be combined with a mathematical or complex (on several subjects at the same time) excursion (top flight) [37].

The main features of studying mathematics at the moment are as follows:

1) increasing the educational activity of students at all

stages of training. Special attention is paid to the Independent Education of students with the help of a teacher;

2) intensification of students ' mathematical thinking in the educational process, i.e. their acquisition of theoretical knowledge in the field of mathematics and assimilation of basic intensive methods of rational thinking.

Learning is a two-way process that involves teaching, teaching on the part of the teacher, and learning, learning on the part of the student. Therefore, in order to become the fruit of learning, there must always be direct and feedback between them. In order for the teacher to control the course of the educational process, it is necessary that information about it is received from the student to the teacher in a timely manner. Only with such information in mind, the teacher will be able to competently intervene in the training of each student during the lesson. This gives rise to the idea of program learning. In this method, the student works according to a specially compiled training program that is included in a programmed textbook or learning machine. The program also provides answers to the questions asked so that the student can monitor the correctness of their work.

The learning program will ultimately become a learning algorithm, so Program learning is closely related to the problem of algorithmization of the learning process. The development and implementation of program learning in school practice will strengthen the role of technical means of learning.

Problem-based learning. Problem-based learning relies on creative, resourceful thinking. Such thinking will be especially necessary for solving non-standard problems. At the same time, the problem method will be most effective in studying and studying mathematical theory. Therefore, we believe that the problem method should become one of the main methods of teaching mathematics in high school in the future.

Currently, the main requirement for a teacher to conduct classes correctly is the ability to manage them, instilling a sense of active ic

activity in students. First of all, it requires not only the provision of ready-made information in the form of data, laws, rules, but also the reorganization of the structure of the provision of educational material, which allows students to independently search for new information from it. Secondly, it requires a change in the attitude of the teacher to the IC activity of students. That is, the teacher should be the organizer and manager of learning, in which the students themselves are an active creative force. It should be manifested at every stage of learning: when checking homework, when students are ready to learn new knowledge, when they introduce new knowledge, formulate it and rely on it, when they summarize and systematize the acquired knowledge.

$$ax = b$$

we mean an equation in the form, where x - is a variable, functions: a, b - is a number.

This definition performs two equations of this class are simply solved and allow us to study it.

1) the equation is written as follows $ax = b$, i.e. it is possible to form equations of this class by transformations. Different methods of introducing linear equations despite everything, the method of teaching them is the same.

The reason is that the main goal here is to master the Basic Rules for solving equations of a given class. Students should be able to solve the following equations:

$$-\frac{1}{3}x = 4; \qquad 3x + 2 = 0; \qquad 9x - 3(x + 1{,}5) = 4x + 0{,}5;$$

$$\frac{x-3}{3} - \frac{2x}{4} = 2$$

Basic concepts: equation, root of equation, solution of equation. The value of a variable, if we convert an equality with a variable to a direct numerical equality, then we call it the root of the equation. By

solving an equation, we mean finding its root.

3.a system of two linear equations with two unknowns.

A) before considering systems of this class, it is necessary to read two unknown linear equations. The point that attracts attention here is to express one unknown through another unknown. Such a transformation is necessary when removing the system by the method of putting it in place, and the introduction of the concept of a graph of equations with two unknowns begins.

Until now, students believed that the solution to the equation was a number, and now it is necessary to show that the solution to the equation of two unknowns is an ordered double number. The fact that there are many
solutions to two unknown equations and its image in the coordinate plane is a line expands the horizons of students.

When teaching this topic, you should pay attention to the following problem. The relationship between the concept of a" function " and the concept of an equation with two unknowns (where one unknown is expressed by another unknown).

$ax + by = c$, $y = -\frac{a}{b}x + \frac{c}{b}$

The main goal of the topic" equations of two unknowns " is to introduce new concepts.

B) when reading the topic" linear equations with two unknowns", students learn from the equation

$y=kx+b$

or $x = ky + b$ get used to passing equations. Again, the problem that needs to be studied is that the graph of the equation $ax + by = c$, $a \neq 0$ or $b \neq 0$ 0 equation is straight, and the ability to plot a graph of two real unknown linear equations.

Before teaching a system of linear equations, the concept of a system of equations is introduced, but a strict

definition of this concept is not given in the school course. Students are faced with $a_1x + b_1y = c_1$ and $a_2x - b_2y = c_2$ the problem of finding common solutions to their equations.

It is advisable to start learning a system of two equations with two unknowns with text problems.

The main content of the topic under consideration consists of two algebraic methods for solving such a system, the graph solution method, and the study of this system. The algorithm for solving a system of linear equations is much more complex than the algorithm for solving linear equations. Therefore, when passing this topic, it is necessary to strictly follow the sequence of each operation used in the algorithm.

4. Quadratic equation.

The concept of a quadratic equation is introduced by giving an open definition. By a quadratic equation, we mean an equation of the form $ax^2 + bx + c = 0$, $a \neq 0$ where b,c is any number.

There are several ways to digest the roots of quadratic equations: for

a general case at once, or for a quadratic equation given first. No matter what method is used,

$$ax^2 + bx + c = 0$$

a complete square is separated from a three-dimensional square. The separation of a complete square of two members from a quadrilateral is shown to students using examples

$$ax^2 + bx + c = a\left(x + \frac{b}{2a}\right)^2 - \frac{b^2 - 4ac}{4a}$$

The main necessary step in digesting the root of a quadratic equation is research: the absence of a root, the presence of one or two roots. Here the concept of "discriminant " is introduced.

Based on this conclusion, the solution of a real quadratic equation is performed as follows: First, the discriminant is calculated, it is compared with zero, and if it is not negative, then the formula for finding the root is used. Sometimes $x^2 + px + q = 0$, $x^2 + 2xp + q = 0$ formulas for solving equations are found in textbooks. Before reading the topic" quadratic equations", you can consider incomplete quadratic equations. Although the algorithms for solving incomplete quadratic equations are different, when studying this topic, it is advisable to show students how to use the general formula for solving a quadratic equation.

One of the most important points when learning a quadratic equation is to consider Vieta's theorem. The difficulty of teaching this theorem is that students confuse the round and reverse of this theorem: in the direct theorem, the square equation and its roots are given, and in the inverse theorem, two numbers are given, the square equation appears in the conclusion of the theorem. For example: when finding the root of a quadratic equation, you need to turn to the

opposite of Vieta's theorem. $D = 0$ in the case of Viet's theorem, we say that a quadratic equation has two mutually equal roots. Mastering the theory of quadratic equations will help you solve other equations considered in the algebra course.

Features of learning inequalities. In general, the method of teaching inequalities is the same as the method of teaching equations. However, the learning of inequalities has its own peculiarities. They are as follows:

1) students' ability to solve inequalities, except for linear inequalities, is lower than their ability to solve equations. The reason is that the theory of inequalities is more complex than the theory of equations.

2) the most common ways to solve inequalities are to move from the given a>в in equality to equality $a = b$ and from the roots of the found equation to the set of solutions of the given inequality. This situation should be monitored by the teacher, as this is the main method of solving inequalities. In the upper classes, it is formed as the" interval method".

3) visual and graphical tools play a great role in reading inequalities.

These features can be used to justify the arrangement of materials corresponding to inequalities. As an example, consider solving a quadratic inequality. Students will be able to solve a quadratic equation and plot a quadratic function."Solve the inequality $ax^2 + bx + c > 0$" find the values of $\Leftrightarrow$ « $y = ax^2 + bx + c$ the argument so that the value of the function is positive". In the second chapter of the dissertation work, examples of methods for teaching inequalities are given and specific visual representations used are described.

3. Irrational and transcendental equations and inequalities.

The definition of various classes of irrational and transcendental equations and inequalities is given in school textbooks as follows:

Irrational (exponential, etc.) equations (inequalities) are those equations that exist under the root of its unknown (exponential, etc.).

Each such class contains groups of simple equations (inequalities). For example:

$$\sqrt[k]{x} = a\ ,\ \cos\ x = a\ ,\ \text{etc.}$$

Complex equations (inequalities) are transformed until they come to this simple form. And each simple equation (inequality) is closely related to the corresponding functions, and its properties are used in solving equations (inequalities).

The difference between irratiohinal equations.

When solving equations of ts $\sqrt{x}$ type, it usually raises both sides of the equation to the same degree. One thing that can be explained to the students here is the appearance of a foreign root, which has been raised to the rank of a couple.

One of the problems that we pay attention to when solving such equations and inequalities is the formation of skills in using peer-to-peer transformations.

The equations used in the transformation can change the area of definition of some of the equations (inequalities).

So:

- mathematics develops thinking: by studying mathematics and solving problems, we learn to generalize and highlight the important, analyze and systematize, find patterns and establish cause-and-effect relationships, reason and draw conclusions, think logically, strategically and abstractly.

- math classes train memory: scientists have studied the process of solving mathematical problems by a person and found out that adults use thinking for these purposes and the skill brought to automatism to " get " the answers already available there from memory.

- mathematics builds character: for the correct solution of mathematical and logical problems, you need care, perseverance, responsibility, accuracy and accuracy.

- mathematics helps to succeed in the humanities: mathematics is an interdisciplinary science, it is closely related to physics, geography, geology, and chemistry. Economics is also inseparable

from mathematics, and many of the conclusions of even the usual humanities, such as linguistics, journalism, are based on mathematical models and concepts, mathematical and logical laws.

In this chapter, an analysis of the current algebra textbooks in general education schools on the topics of equations and inequalities, as well as a description of the traditional teaching methodology. Even in the traditional teaching methodology, each teacher carries out interdisciplinary communication depending on the level of knowledge of students of their class, attendance activity, and the volume of tasks set in the current textbook. In the course of passing these topics, students are often explained and shown the connection with physics, information and communication technologies, etc.

III USE OF ICT OPPORTUNITIES IN ORDER TO IMPLEMENT INTERDISCIPLINARY COMMUNICATION IN TEACHING SECONDARY SCHOOL MATHEMATICS

3.1 The importance of using the functions of Information technologies and special programs in teaching mathematics

"Teachers should be qualified in the field of information technologies and methods of their use as an effective learning tool, in particular, be able to effectively use digital resources in the learning process, as well as use an automated management system for monitoring the educational process of students", the conclusion is reflected in the comparative analysis of the Innovative Training Center in the country [38].

In the modern Information Society, information processes based on the use of information and communication technologies are one of the main features of the development of civilization. The process of informatization of society affects the education system, creating the need to change the nature and content of Education.

The main goals of using ICT in general education schools can be called the following:

1) formation of functional literacy of students, basic reading skills, provision of profile and pre-profile training;

2) improving the quality of knowledge, skills and abilities acquired through the implementation of the advantages of ICT, stimulating cognitive activity in order to activate it, deepening interdisciplinary contacts based on the use of modern information processing tools;

3) formation of Information Culture as one of the components of general culture, which is recognized as the highest manifestation of knowledge and consists of the qualities and professional qualifications of the individual;

4) taking into account the individual characteristics of

students in the learning process, developing students ' abilities in a certain direction;

5) preparation of students for independent educational and cognitive activities using information and communication technologies;

6) development of the student's personality, disclosure of his creative abilities, skills in research;

7) creation of a unified information environment as hardware, software systems, as well as content additions to provide information requests based on modern technological solutions, organization of information flows for operational communication related to and necessary for the activities of students [39].

The age of high Computer Technologies imposes new demands on Modern teachers. The education system, taking into account the requirements of the time, should promptly change its own approaches to preparing young people for modern society. The ultimate goal is not to use technology, but to change the culture of the classroom and school in order to support and encourage thinking and independence in teaching students. It is necessary to achieve the development of the culture of the classroom without changing, adapting to the requirements of the time, constantly improving the professional skills of teachers, and the teacher must master rational ways of working with information. ICT-based learning strategies used in classrooms should help students learn to be flexible and think innovatively, work effectively together, and make optimal, valuable judgments. Mastering computer technologies should become an element of the teacher's professional culture. In addition, it is important for a teacher to learn how to use ICT to improve the teaching methodology of their subject.The teacher noted that the use of ICT (interactive whiteboards, electronic textbooks and tools, electronic encyclopedias and reference books, training and testing programs, educational resources of the Internet, video and audio equipment, interactive lessons, conferences and competitions, distance learning) allows students to actively engage in work, improve the perception of information, attention, improve

understanding and memorization of the material, show a picture of the results of the actions performed, make it possible to create interesting research papers and projects.

When preparing for a lesson using ICT, the teacher should remember that the lesson plan should be based on its goals. when selecting educational material, it is necessary to observe the following basic didactic principles: consistency and consistency, accessibility, method of differentiation, science, etc. It is clear that the computer does not replace the teacher, but only performs additional functions. Characteristics features of such a lesson:

1. adaptation principle: it is necessary to adapt the computer to the individual characteristics of the child.
2. Management: the teacher can make adjustments to the learning process at any time.
3. interactivity and dialogic nature of training. ICT has the ability to respond to the actions of students and teachers, "get into" a dialogue with them, which is the main feature of computer teaching methods.
4. rational combination of individual and group work.
5. providing psychological comfort when communicating with a student's computer.
6. Unlimited learning: the content of knowledge, its interpretation and the scope of its application are very large [40].

Among the main functions of ICT, the following features can be distinguished (table 2).

Table 2

Classification of ICT tools by methodological content

ICT functions	Content
Training	To achieve a certain level of perception, they communicate their knowledge, form their skills, and skills in practical activities.

Information-search and reference books	Provides knowledge on information systematization, forms competencies and skills
Demonstration	It makes it possible to imagine the studied objects, phenomena and processes for the purpose of research.
Modeler	Allows you to model objects, phenomena, and processes for research purposes.
Exercise equipment	Creates conditions for working with different qualifications and skills, repetition and consolidation of the studied material.
Imitation	To study structural or functional characteristics, it offers a certain aspect of reality.
Laboratory	Makes it possible to conduct remote experiments with real equipment
Learning is a game	Organizes educational and game situations that create conditions for studying and understanding educational material

The information provided in this picture is published in UNESCO materials based on the results of Special Studies [41].

The basis of learning technology, that is, more broadly, pedagogical technology, is an important component of social technology, which, depending on the success of methods and means of processing, storing, transmitting information, can have all the opportunities for development. In the course of the formation and development of the concept of pedagogical technology, the essence of the concept of pedagogical technology is considered differently. The analysis of works devoted to the problem of pedagogical technology shows that different views are expressed, from the concept of teaching technology with the help of technical means to the scientific understanding of pedagogical technology (Z.A.Mansurov, M. C.Malibekova, U. A. Kossybayeva) [42-44].

The technology of teaching is used in school as a systematic set of psychological actions, such as methods, methods, techniques, and didactic requirements necessary for the educational process. It has a positive impact on students ' discipline, motivation to learn, and educational activity, but also plays the main root of the educational process, bringing pedagogy closer to exact science, which effectively affects the effectiveness and compactness of pedagogical practice, which is an intellectual and creative activity of teachers.

The same technology can be implemented in different ways, depending on the skill of the performers. It is known from the literature that more than 50 pedagogical technologies are used, which include trends and trends in the development of modern education. But it is difficult to distinguish it from the traditional methodology, even if teachers are not used to using it systematically in their practice. The goal is to design a holistic learning technology; create a pedagogical process that aims to achieve the goal; choose and create a system that allows the teacher to analyze and explain the result; development of a system of preventive and correctional work with students; development of technologically reliable dynamics of development of general pedagogical qualifications; formation of a new teacher who implements the projected technology [45].

General education schools have a personal computer equipped with additional devices based on existing information technology tools.

Modern society has set teachers the task of not only education, but also the development of individual qualities of students. Today, Education is considered not a goal, but a means of personal development. To do this, you can use modern Information Computer Technologies.

Now let's describe the features of using information technologies in mathematics lessons. The purpose of using a computer in a mathematics lesson is as follows: the development of an interdisciplinary connection between mathematics and Computer Science, the integration of educational topics, the formation of computer literacy, the formation of skills of working in the

classroom by the student himself.

The use of ICT in mathematics lessons allows the teacher to save time on teaching materials due to visibility, test students ' knowledge in an interactive mode, develop intelligence, and improve the student's Information Culture. In this regard, there is a need for the teacher to be able to use the same act, special programs. The use of ICT in the classroom will improve the quality of knowledge, that is, one of the main problems for the time being will be solved [46].

Now let's systematize the possibilities of using various types of multimedia technologies at the main stages of the lesson, which makes the lesson first modern and second high-tech (table 3):

Table 3

Use of information technologies in lessons

Stage name	Multimedia technology
Organizational stage	
Checking your homework and knowledge	test material, presentation
Setting a lesson goal (problem-based learning).	Srategy white
Organization of assimilation of new Material	Video film, Internet
First test of lesson understanding	Presentation theoretical mater material data, the algorithm animates
Fixing new material	Presentation, interactive chat
Repeat, apply the acquired knowledge	Presentation, video, movie, illustrative material
Summing up the lesson results	Presentation
Home work assignment	Presentation, screen, slide

Students are always attracted by the novelty of classes. During

such classes, sincere communication is established in the classroom, students strive to express their opinions, diligently perform tasks, show interest in materials, and students ' fear of the computer disappears. Students learn to work independently with textbooks, reference books, and literature on the subject, and students are motivated to achieve high results and perform additional tasks. The results are noticeable when performing practical tasks. And to ensure the effectiveness of the educational process:

- develop the ability to focus on the levels of students ' activity, avoid ambiguity; perceive, apply, direct the development of the child's thinking, control and compare, distinguish the head, generalize, and successfully use computer technologies in the classroom;
- accounting of the child's memory (fast, short-term or long-term).

At the same time, we can talk about the mathematical capabilities of MS Excel in teaching mathematics. The reason for receiving this program is that students from the 5th grade to the 11th grade learn this program in high school, which is held in a special lesson. Therefore, it is profitable to use the program. One of the most convenient, well - known and easy-to-use programs for most is Microsoft Excel. Microsoft Excel is an application program for creating spreadsheets, created in accordance with modern requirements, using the most advanced models running on IBM and Macintosh computers. In the latest versions of Excel, features such as graph construction, calculations using complex functions, and parallel work with multiple workbooks are widely used. Tabular structure is one of the most common tools for working with documents. It is based on working with numerical data, charts make it easier to compare and perform, and is a tool for displaying data.

Charts are built on the basis of data located on the working pages. The chart is located on the page in the same way as a graphic object with data. The chart can be printed. In this program, the mathematical function is grouped separately (figure 5).

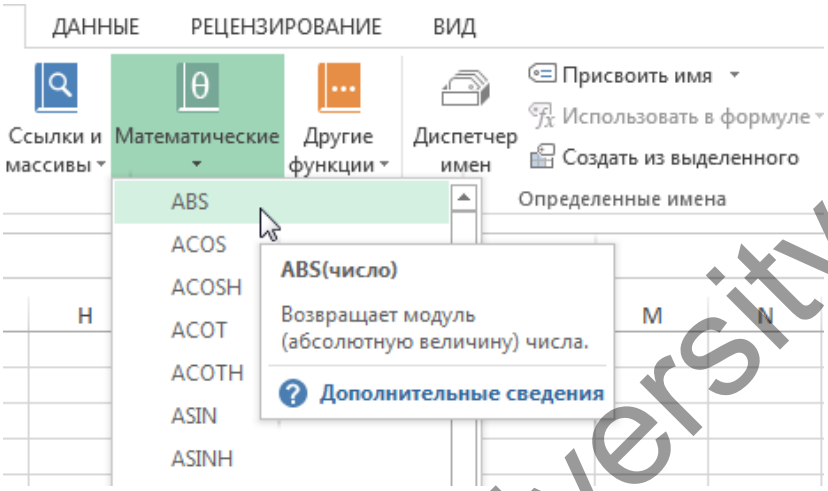

Figure 5. Mathematical functions

Excel functions can be used specifically on a worksheet for standard calculations. Different calculations are performed by introducing different functions where the formula is created. All such functions are grouped and grouped into several groups in the program, which means that they are effective and convenient for the user.

Today, the preparation of visual materials on mathematics is an important part of the course of the lesson. Because with the development of information technologies, it is not easy to organize classes without resorting to them, and it is possible to increase interest in the subject by relying on technical means in specially equipped classrooms of schools.

3.2 Using the capabilities of computer programs in teaching the topic of percent

The main task of modern schools is to widely develop students ' mental activity, independently update and replenish knowledge, teach them to use it efficiently and in solving theoretical and practical problems.

In the search for ways to significantly improve the quality of Education, N.Chebyshev and V.P.Kogan, justifying the concept of interdisciplinary communication, propose a specific educational and methodological mechanism for its implementation in educational practice. The problem of innovative activities in this direction should be solved in general education schools.

Therefore, the activity of the teacher is of great importance in the selection and practical testing of various learning technologies based on the content of learning and the age and psychological characteristics of students. G.K.Selevko notes "Mastering advanced learning technologies in the field of modern education has a beneficial effect on the formation of intellectual, profes ional, moral, spiritual, civic and many other human qualities of the teacher, helps him to develop himself and effectively organize the educational process".

Let's talk about the possibilities of special computer programs that can be used in mathematics lessons in general education schools. There are many such programs today, but each teacher chooses the most suitable ones to reveal the topic of study, taking into account the capabilities of their programs, their experience in this program.

Matlab is the most common automated mathematical calculation system today. In it, many mathematical calculations are solved only by using ready-made functions.

This system was invented by S. V. Moler in the 70s of the XX century, and it was already used in large computing machines. And in the early 80's MathWorks. In 1993, the company was founded in 1993 by John Little, who developed the PC Matlab version for IBM PC Macintosh personal computers [47].

Matlab covers all methods in the field of mathematical calculations throughout the history of mankind and is a powerful computing system. This is the advantage of the system, that is, you

can change the functions included in it (through M-Files written in text and programs written in C), insert applications. You can also perform graphical functions (two-dimensional, three-dimensional) in addition to numerical calculations. Compared to MS Excel, which was discussed in the previous section, the possibilities for mathematical functions in this environment are given more (figure 6).

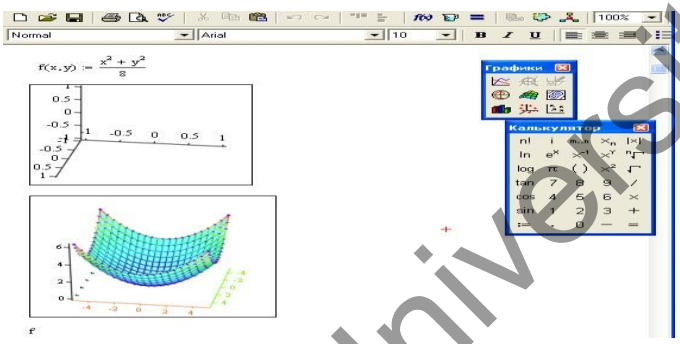

Figure 6. Program environment

Another program that combines such mathematical capabilities is Mathcad. It is a well-known system of computer mathematics aimed at automatizing the solution of large mathematical problems in various fields of Science and technology, education. The name of the system consists of two words – MATHematika (mathematics) and CAD (computer Aided Desiq – automatic design system).

Today, various versions of MathCAD are a mathematical-oriented universal system. It allows you to easily solve complex calculations that are difficult to convey by text editors and spreadsheets. With the help of MathCAD, you can prepare articles, books, dissertations, scientific calculations, diploma and course projects not only with high-quality texts, but also with a set of the most complex mathematical formulas, which are easily implemented, and the result of calculations with graphic representations. The program is a convenient environment for users to work for both

beginners and professionals (figure 7).

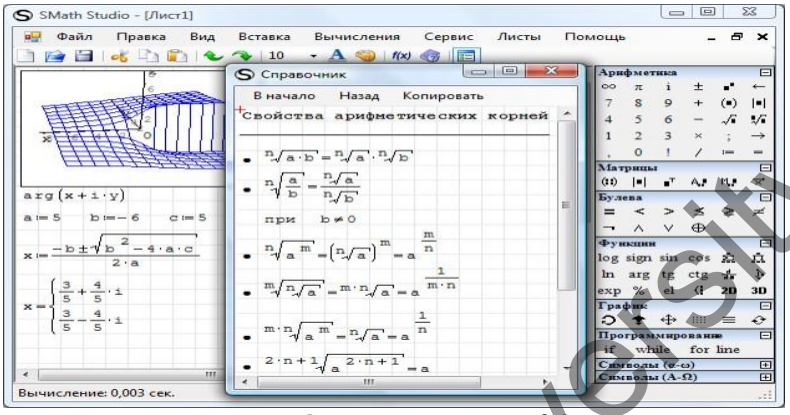

Figure 7. Working environment of the program

One of the most commonly used programs is MS Excel. The use of information technologies in mathematics lessons is very important, because mathematics and computer science are closely related, and it is necessary to show this connection to students. During the lesson, students can get acquainted with the possibilities of using the Microsoft Office package. The use of MS Excel is particularly necessary and effective when studying the following sections of mathematics:

- creating graphs of functions;
- study of the properties of functions;
- study of interest reports;
- conversion of graphs of functions;
- graphical solution of systems of equations.
- solving equations using the "search for solutions" method.

In addition, presentations on calculations made on special sheets with the help of this program in mathematics lessons also play an important role in the lesson. In such classes, materials for students are implemented on the principles of accessibility and visibility. Such classes are effective in their aesthetic appeal, and there is also

an auxiliary computer between the teacher and the student, which often contributes to effective interaction. A lesson-presentation can provide a large amount of information and tasks in a short period of time. You can always go back to the previous slide, fix the time, add sound, save or recycle materials.

Conducting classes using information technologies is a powerful incentive for learning. Through such classes, students ' mental processes are activated: perception, attention, memory, thinking; the excitement of cognitive interest is more active and rapid. By its very nature, a person trusts the eye more, and more than 80% of the information is perceived and remembered through the viewer's analyzer.

The interest topic, which we take as an example, is taught in high school mathematics in the 5th grade in the amount of 12 hours, which is given in the long-term plan for the class (table 4).

Table 4

Assignment of the interest topic in the 5th grade

5.4 Percent A (12 hours)	Percentage	5.1.1.16 mastering the concept of percent;	2
	Finding a number by percentage and a number by percentage	5.1.2.33 convert a fraction to a percentage and a percentage to a fraction ;	1
	Finding a number by percentage and a number by percentage	5.1.2.34 find the percentage of a given number;	1
	Finding a number by percentage and a number by percentage	5.1.2.35 find the percentage ratio of one number to another and vice versa;	2
	Finding a number by percentage and a number by percentage	5.1.2.34 find the percentage of a given number;	1

	Output of text reports	5.1.2.35 find the percentage ratio of one number to another and vice versa;	2
	Output of text reports	5.1.2.36 finding a number by a given percentage;	2
		5.1.2.36 finding a number by a given percentage;	1

In general, the long-term plan for the 5th grade is given in the appendix (Appendix 1).

One of the main directions of society today is informatization of the educational process. Currently, the process of informatization is considered as a massive and irreplaceable stage in the development of human civilization. Informatization of education, especially its introduction at the first stage in school, is the main condition for informatization of society. After all, the school provides training for future generations who can work and live in a society where new information is available.

We have listed some programs that are convenient to use in teaching mathematics, the environment is easy for both the teacher and the student, and there are many ways to provide. The use of a computer as a tool in the process of learning algebra leads to many changes in the process of teaching and upbringing. Recently, in the context of computerization of the educational process, works dedicated to the professional orientation of teachers have appeared, and this issue has been comprehensively considered in the works of foreign and Kazakh researchers.

There are quite a lot of definitions for such tools. For example, ICT tools-have great opportunities to achieve your goals at the training stages:

- ICT is a tool for recognizing;
- improving students ' cognitive activity through ICT;
- introduction of computer technologies in the educational

process;

- ability to work with multimedia tools;
- methods of using multimedia tools in the classroom;
- unified didactic purpose of the lesson;
- advantages of using multimedia presentations;
- creating multimedia presentations [48].

The use of information and communication technologies in mathematics lessons becomes a common phenomenon, allows you to expand the information field of the lesson, increases the interest and motivation of the child. Therefore, I also use a computer in my classes, that is, in teaching mathematics, first for interdisciplinary communication, and secondly for mastering new materials, taking into account the age characteristics of the child. "I'm sorry," I said.:

- for diagnostic testing of the quality of assimilation of the material;
- in training mode to work out simple skills and abilities after studying the topic;
- in the learning mode, when working with lagging students, the use of a computer usually significantly increases interest in the learning process;
- in self-learning mode;
- in the mode of graphic representation of the read material.

The use of a multimedia projector in the classroom is effective, the computer allows the teacher to expand the possibilities of a simple lecture, show students color schemes and perform Assembly "in real time", use sound and animation for interpretation, quick links to previously studied material. In my classes, I often use additional materials created independently or working online with presentation creation environments as recycled presentations. He:

- show students examples of careful, clear solution design;
- representation of absolute abstract concepts and objects;
- achieving an optimal pace of student work;
- increase the level of visibility during training;
- study, use of a large amount of material;
- show students the edges of geometric drawings;

- increase cognitive interest;
- introduction of interesting elements, activation of the educational process;
- introduction of level differentiation of training;
- adaptation to the use of special computer programs for teaching mathematics;
- achieve a fast feedback effect.

The intensity of mental load in mathematics lessons allows students to maintain interest in the subject being studied throughout the lesson. At the same time, the development of a student's mathematical knowledge is carried out not only in the classroom, but also when performing independent work at home. Today, there are many ready- made computer programs. The role of the teacher consists in careful selection of material for the lesson, competent placement of accents and creation of his own WEB resource.

Modern computer technologies create great opportunities for the development of the educational process. According to K. D. Ushinsky: "the nature of the child requires visualization." Now these are not drawings or tables, drawings, but scientific and educational games that are close to the nature of children.

5 main didactic functions of the computer in teaching mathematics are considered:

- perform exercises for students to adjust tasks by difficulty;
- use of an electronic whiteboard, multimedia projector in algebra lessons;
- modeling;
- study of the student's own decision-making from the proposed option;
- mathematical calculations in courses of other subjects. Teachers should master the following issues::
- computer literacy;
- mastering the skills of working with a personal computer;
- mastering new technological programs in the flow of time;
- learning in a new way, analyzing the essence of the problem, phenomenon considered in computer training, on previous topics.

The subject of mathematics is not interesting for many students, it was adopted only for the purpose of getting grades in the report and control work in front of the blackboard. Getting out of this deadlock with the help of new information technologies showed the "viability" of the subject of algebra.

The use of ICT in teaching mathematics to implement interdisciplinary communication is one of the major influencing factors in teaching. It is obvious that it affects the course, time, and result of the lesson. So, in this section, we described the use of special programs in order to implement interdisciplinary communication in teaching mathematics in general education schools, and showed that these programs can also be used so that students have a high chance of mastering the material of the discipline.

3.3 Ways to implement interdisciplinary communication in the context of updated educational content

One of the subsequent innovations in the education system of the Republic of Kazakhstan is the updated content of Education. Content features of these updated training programs:

- the principle of "spiral" when designing the content of the discipline, i.e. the gradual expansion of knowledge and skills both vertically and horizontally (complicating skills by topics and classes);
- hierarchy of educational goals according to bloom's taxonomy, classified by the most important types of subject operations and based on the regularity of cognition;
- formulation of pedagogical goals by levels of education and throughout the course of study, which allows us to take into account intra-subject contacts as much as possible;
- availability of common topics for the implementation of inter-subject relations within the field of knowledge, as well as

interdisciplinary contacts;

- compliance of the content of sections and proposed topics with the requirements of the time, emphasis on the formation of social skills;
- technologization of the educational process in the form of long-term, medium-term, and short-term plans [49].

Another feature of the new training programs is their focus on the formation of not only subject knowledge and skills, but also a wide range of skills. The system of educational goals is the basis for the development of a wide range of skills: functional and creative application of knowledge, critical thinking, conducting research, using information and communication technologies, using types of communication, working individually and in groups, problem solving and decision-making.

The flexibility and versatility of the updated curriculum is its most important characteristic. Teachers have the right to independently determine the order of teaching chapters and sections within the framework of the chapter and the corresponding quarter. Teachers can create tasks aimed at achieving several goals. The curriculum allows teachers to divide the learning goal into several goals that lead to the achievement of the learning goal in the curriculum, provided that the learning goal is fulfilled in a set. Teachers can independently determine the number of hours assigned to the topic /purpose of training. This decision can be made at a meeting of the educational and methodological Association. When planning, teachers should take into account fixing and repeating lessons [50].

The model of the lesson plan for the updated content of Education has also changed, and new requirements have been introduced. Within the framework of our chosen topic, we have dedicated a short-term plan for one lesson to the topic "percentages" in accordance with the conditions of this updated educational content. In this paper, we have listed the analyzed stages of the lesson, and in addition, we have presented a detailed short-term plan. First, you must specify the topic and purpose of the lesson (table 5).

Table 5

Short-term plan extract

Chapter of the long-term plan: 5.4 percent of a school:
Date: full name of the teacher:
Class: 5B present: 20 absent:
Lesson topic finding a number by percentage and percentage
Learning objectives to be achieved in this lesson (link to the curriculum) 5.1.2.34
find the percentage of a given number;

The purpose of the lesson is now grouped according to what students know (table 6).

Table 6

Lesson goals	All students: know the concept of percentage. You can write a percentage as a fraction , a fraction as a percentage. Knows the rule for finding a percentage of a given number. Most: can find a percentage of a given number. Some students: can solve problems to find a percentage of the number found in everyday life

In the short-term plan, it is mandatory to specify the evaluation criteria and the language goal (table 7).

Table 7

Extract from the short-term plan

Evaluation criteria	Student: - Generates reports using the rules for finding the percentage of a given number. - * Learn to solve life-related problems to find a percentage of a number.
Language goals	Students: can read percentages, discuss reports, communicate their thoughts to others, engage in dialogue, prove, and draw conclusions.

The interdisciplinary connection analyzed in our topic is necessarily reflected in the short-term curriculum (Table 8).

Table 8

Part of the short-term plan

Interdisciplinary connections	Geography, economics, chemistry
Previous education	Details

Using the" two stars one wish " method, one review of what children understand is conducted.

Students were asked questions through the prepared presentation:

1. What is a percentage?
2. How is the percentage written with a simple fraction?
3. How is the fraction written as a percentage?
4. How is the percentage of a given number found?
5. How do I find a percentage number?

By the method of"hot micraphone", the systematization of students 'knowledge acquired so far on the topic" percentage " is carried out. Creative work was carried out with the group during the lesson.

Creative Work . Group 1: Create and solve life-related problems on the topic of interest. Group 2: "What do we know about the interest topic?"(Search for additional information on the internet). Working with a poster in the" land of percentages".

At the same time, in the middle of the lesson, a refreshment period of 3 minutes was performed (figure 8). Mathematical brain training game. Placing numbers in order by moving them.

Figure 8. The moment of refreshment

The presentation prepared for the moment of refreshment is shown to students. During the lesson, practical tasks were organized as group work using the" thumb " method (figure 9):

Practical Work
Group 1: paint 20% of all apples red, 25% yellow, and the rest green.
Group 2: What percentage of all students study in the Class from "4"to "5"? 3rd

Figure 9. Example of working in a group

A mathematical dictation was conducted using the" three claps " method. To summarize the lesson, feedback was received and the result was summed up using a flipchart.

Since we have chosen the 5th grade, taking into account the age characteristics of students in the class, we conduct a formative assessment of the results of the lesson using one of the following methods (table 9):

Table 9

Formative assessment approaches

Approach	Meaning
The "corners" approach	The teacher offers students a question and places four possible answers in the four corners of the class. Students stand next to the correct answer, formulate their chosen answers in group work, and prove their point of view.
"I don't know," he said.	To achieve an increase in the level of understanding of the topic and the development of discussion skills, it is necessary to "throw" questions among students in the classroom: for example, "Asan, do you agree with the opinion of the Mirror?", "Mirror, how else can you complement the answer to Asana?", "Asan, how can you formulate your statements in one word?»

Knock out the question	When the teacher asks a question, he throws a bag of peas at the students. This gives the request process a kinesthetic character and encourages students to respond voluntarily. If the student does not know the answer, they are given the opportunity to throw the question to another student. Depending on the complexity of the questions, you can set its initial weight (by points). For example, if a Knocked-Up student throws a bag at another student without knowing the answer, the cost of the question is reduced by 1 point. This task can also be used between small groups; here the teacher throws the bag in groups in turn.
"Think-pair-share»	On a given task (question), each student summarizes their houghts and shares their opinions in pairs, working individually; this leads to a whole group discussion.
Question on the envelope	Prepare an envelope for each student and write 2-3 questions according to the purpose of training and put them in the envelope. Give 2 minutes to distribute the envelope to students: the student writes his name on the sticker, answers to questions, puts it in the envelope and sends the envelope to the next student. All students exchange envelopes until they respond. At the end, collect stickers and read some answers aloud (without naming their names); the class discusses how correct the answers were

Based on the materials presented in the theoretical and practical parts of this work, we will give a sample of one lesson conducted in the 5th grade:

5.4. A. Percent Class: 5

Number of participants: 18 number of participants: 0

Lesson topic: finding a number by percentage and percentage

Learning objectives to be achieved in this lesson (link to the

curriculum)

5.1.2.36 finding a number by a given percentage Lesson goals

All students:

* Provides an algorithm for finding a given game.

- I'm sorry, " she said.

Priority:

* Can solve problems using a given game detection algorithm Some students:

* Can analyze the percentage by linking it to the reports you encounter in everyday life. Success criteria

Students:

Uses an algorithm for finding a number by percentage Can determine the number by percentage.

Can solve text problems related to percentages. Language goals

Can explain the algorithm for finding a number based on the value of a percentage, the value and mathematical meaning of the result expressed as a percentage.

He is able to discuss reports, communicate his thoughts to others, and draw conclusions. Vocabulary and terminology related to the discipline: Percentage; Percentage Ratio; percentage increase; percentage decrease;

Instilling values:

Students work in a collaborative environment. Communicating with each other, he gets used to listening to the opinions of others, openly expressing his opinion.

Interdisciplinary connections Kazakh language, technology, ICT Lesson progress:

Planned activities in the classroom:

Resources: cards, textbook, workbooks Start of classes: 2 min

Organizational stage.Greeting students, inventory of students.

Creating a psychological climate. Using the" warm wish " method, students write a wish for each other on stickers and give these stickers to each other and are divided into groups by the color of the stickers. Evaluation sheets are distributed.

Evaluation sheet

Full name of the student: Class:

Date:

"Let's think together» "Think-pair-share» Level task

Table filling Conclusion 3 points

3 points

9 points

3 points

18 points

Engaging students in a question-and-answer dialogue on the completed lesson using the" breakthrough question “method”:

1. what does one percent say?
2. how is the percentage written in fractions?
3. how is the fraction written as a percentage?
4. how is 1% of a given number found?

Middle of the lesson: introduction to a new lesson.

Before starting a new lesson, give a preliminary task in the textbook in order to train your mind. Does teamwork.

Task: 560 kg of vegetables were sold in the store. This is 70 percent of all vegetables in it. How many kilograms of vegetables in the store? To create a report, answer the following questions::

How many kilograms are 1 of them if 70 of the vegetables in the store are 560 kg?

It is known that all the vegetables in the store are 100, then how many kilograms are all the vegetables in the store?

To reveal the topic of today's lesson to the students themselves using the method of" wait and sum up".

Listen to the opinions of groups.

Each group must draw its own conclusions, draw a formula, and write the rule on the flipchart. To find a number based on a given percentage:

1) the percentage must be expressed by a simple fraction or decimal.

2) divide the given number by this fraction

Let's write in letters: where A is the desired number, P is the number of percentages, and b is the number of percentages.

Lesson approval tasks

Working with a textbook: students perform a pair of works using the" LeT's think together " method.

№ 1601

Find the number by percentage:

3%: 12,15,21,36.

60 %: 42, 72, 102, 114.

Handle Score

Can express a percentage with a fraction-1 Can divide a given number by this fraction-1

By percentage, the number is determined and the decision is punished-1 Giving group tasks using the" Think–pair –share " method.

Group I

№ 1603

The master prepared 295 parts and fulfilled the plan by 18% more. How many details did the master plan to prepare?

Group II

№ 1614

On the first day, motorists covered 36% of all roads, on the second day-39%, on the third day-the remaining 180 km. How many kilometers did the car tourists travel in total?

Make a roll-up exercise using the game" let's not get confused".

1. the largest unit of time measurement?
2. what number is 100?
3. what percentage is one part out of two?
4. what is in the Earth?
5. in the same house, a father sits with his child, and a grandfather sits with his grandson. How many people are there in the House?

The method of " level – differentiated learning". Assignment of level tasks taking into account the individual abilities of students

/personal work/

№ 1

Find the number by percentage:

1. 12%: to 18 m, 75 m-Goethe.

2. 24%: 9.6-gathen, 42-gathen.

№ 2

80% of the Ingot is aluminum, the rest is copper. Aluminum in ingots is 300 grams more than copper. What is the mass of the ingot?

№ 3

The clothing factory increased the price of clothing by 5%, then sold it by 20%, which amounted to 8400 tenge. What is the first price of clothing before the increase in price?

Summing up the lesson: filling in the table, individual task Number

60

180

Percentage 5 %

90 %

11 %

30 %

Percentage of number 270

110

Handle Score

Finds the percentage of a given number -1 Finds the number by percentage -1

The table is complete and error-free -1 Textbook, flipchart, markers, handouts. End of lesson

2 min.

Students give feedback using the" add, subtract, interesting " method.

Handouts: differentiation – how do you plan to provide additional assistance? How do you plan to complicate the task for students with high abilities?

Assessment-How do you plan to check what students have learned? Interdisciplinary communication: safety and labor

protection rules, ICT.

In order to determine how students learned the lesson, I used the method "let's think together" in pair work, the method "think-pair–share" in group work, and the method "level –differentiated learning" in individual work.

There was an assessment of students by means of discretors. Final assessment

What two things were successful (take into account both learning and learning)? 1:

2:

What two things have made the lesson better (consider both learning and learning)? 1:

2:

During the lesson, What did I learn about the class or individual students that would help me improve my next lesson?

Today, the preparation of visual materials on mathematics is an important part of the course of the lesson. Because with the development of information technologies, it is not easy to organize classes without resorting to them, and it is possible to increase interest in the subject by relying on technical means in specially equipped classrooms of schools. In this regard, the use of computer programs provides a wide range of opportunities.

In the second chapter" using the possibilities of ICT in order to implement interdisciplinary communication in teaching secondary school mathematics", we considered practical problems on the topic of our work and performed the following sections: the importance of using the functions of information technologies and special programs in teaching mathematics, the use of the capabilities of computer programs in teaching the topic of interest, ways to implement interdisciplinary communication in the context of updated educational content. Since the second part was practical, we made a short-term plan for the lesson for interest, thereby showing the features of the thematic lesson, the implementation of interdisciplinary communication.

IV. ANALYSIS OF THE IMPLEMENTATION OF INTERDISCIPLINARY COMMUNICATION IN HIGH SCHOOL MATHEMATICS IN ACCORDANCE WITH THE UPDATED CONTENT OF EDUCATION

The connection between academic subjects is a reflection of the objectively existing connection between individual sciences and the connection of sciences with technology, with the practical activities of people. This is one of the main tasks of the updated content of education. This task is taken into account in the standard programs of all secondary education subjects.

Interdisciplinary connections in school education are a concrete expression of the integration processes taking place today in science and in the life of society. These connections play an important role in increasing the level of practical and theoretical training of students, an essential feature of which is the assimilation by students of the generalized nature of cognitive activity. The implementation of inter subject connections contributes to the formation of students ' holistic understanding of the phenomena of nature and the relationship between them, and thus makes knowledge practically more meaningful and applicable.

The branch of JSC "National Center for Advanced Training "Orleu", has published a collection of answers to the most frequently discussed questions by teachers on updating the content of secondary education in the Republic of Kazakhstan "Updating the content of secondary education: questions and answers". We present some materials on the topic of our work:

1. What are the distinctive features of the updated curricula?

Answer: The distinctive features of the updated training programs are:

- the principle of spirality, that is, the gradual increase of knowledge and skills from topic to topic, from class to class;
- focusing on learning objectives based on the formation of

students ' thinking skills from elementary (knowledge, understanding, application) to high levels (analysis, synthesis, evaluation);

- the presence of "cross-cutting topics", which allows you to organize inter subject communications as efficiently as possible, serving as the basis for the full implementation of the currently particularly important trilingualism program.

2. What information can a teacher find in the curriculum? Answer:

- goals, objectives and significance of the subject;
- information about the developed knowledge, skills, ideas, views and
- values;
- pedagogical techniques used in teaching the subject;
- application of information and communication technologies;
- a brief overview of the evaluation methods.

3. What is a prerequisite for teaching, what is the role of the teacher?

Answer: Creating a collaborative environment, involving all students, developing students ' self-confidence, responsibility, introspection, reflection, as well as the ability to plan all activities, effective use of resources, providing feedback and monitoring students [52].

The analysis of special and psychological-pedagogical literature has shown that at the present stage of time there are many definitions of the term "inter subject relations". Among them, there is practically no single understanding of this definition, because many authors try to reveal the essence of the concept of "inter subject relations" in their own way. According to the updated content of education, inter subject communication is also defined as STEM education. Based on the analysis of the literature, we will identify the following definitions of "inter subject relations" and conduct a content analysis.

- "inter subject communication is a comprehensive approach to the educational process, which allows you to determine the main

elements of the content of education and the relationship between academic subjects."

- Inter subject relations: the relationship of all the main elements of a holistic system of knowledge about the world, society and man.
- Inter subject relations are defined as a pattern that is important to take into account when performing, determining the content, forms, methods and techniques of teaching students, in the classroom and in extracurricular work.
- In a logically complete form, inter subject connections represent a conscious relationship between the main elements of the content expressed in a single form.
- iccording to another definition, inter subject communication is a pedagogical category for the designation of integrated relations between objects, phenomena and processes of the present reality, and the content, forms and methods of the educational process that perform educational, developing and educating functions in their limited unity.
- interdisciplinary communication is a didactic condition that reflects in the educational process the formation of the perception of the world as a whole, corresponding to the level of development of science at this stage of time and the practical activities of society. According to this, the knowledge of students becomes specific and generalized, which allows you to apply this knowledge in practice.

On the basis of the selected definitions and the requirements of the state educational standard of secondary general education for meta subject results, which are as follows: - this is the development of universal learning activities by students, which form the basis of the ability to learn, as well as the ability to independently determine goals, formulate tasks, plan ways to achieve goals and solve problems, we will analyze the definition of "inter subject connections". The following keywords are crucial in textbooks and regulations:

- comprehensive approach to education and training;
- the relationship of all the main elements;

- a pattern;
- conscious attitude to various elements of the educational structure;
- didactic condition;
- educational category.

Based on the conducted analysis and the requirements of the state mandatory standard of training, we will distinguish the following definitions of "inter-subject relations". This is a didactic condition that reflects in the educational process the formation of the perception of the world as a whole, corresponding to the level of development of science at this stage of time and the practical activities of society. According to this, the knowledge of students becomes specific and generalized, which allows you to apply this knowledge in practice.

Taking into account the stated topic of the final qualification work

In the psychological and pedagogical literature, integration is considered as a means and goal of learning. Integration serves as a goal when the student is supposed to create a holistic view of the surrounding world, and as a means-when it is necessary to find a common support for the convergence of subject knowledge [53].

Thus, we formulate the definition of integration: integration is the relationship of academic subjects, as well as sections and topics of academic disciplines based on the main idea and provisions with an in-depth disclosure of the studied processes and phenomena.

Integration on the basis of interdisciplinary connections is a natural relationship of sciences, academic disciplines, sections and topics of academic subjects based on the main idea and provisions with an in-depth disclosure of the studied processes and phenomena (figure 10).

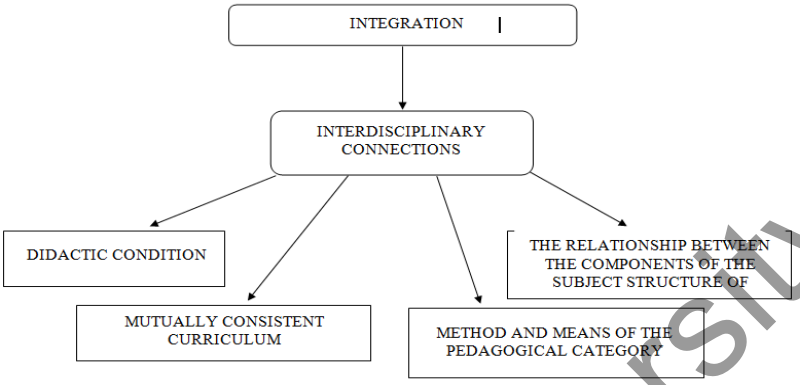

Figure 10. Intra subject relations as a system-forming component of integration

One of the classifications is based on a temporal feature: preliminary, concomitant, and subsequent inter subject relationships. In practice, such connections contribute to the systematization of knowledge, allow you to rely on previously passed material on related subjects, to identify prospects in the study of knowledge. We distinguish three essential features in the definition of inter subject relations: composition, method, and orientation. As well as the types of inter subject relationships that implement these features •

- by composition-objects, facts, concepts, theories, methods;
- by method – logical, methodological techniques and forms of the educational process, with the help of which the links in the content are implemented;
- by orientation-the formation of general skills and abilities.

In the course of mathematics, interdisciplinary connections can be implemented in the study of subjects of the natural science cycle: physics, chemistry, ICT, geography, economics, etc. Also when studying subjects of the humanities cycle: native language, literature, English, history, biology, etc.

Tables 1 and 2 illustrate the content of academic subjects in

which the inter subject relationship between mathematics and the subjects of the natural science and humanities cycles can be used (table 10, 11).

Table 10

Intra subject relationship between mathematics and natural science subjects

№	Subjects of the natural science cycle	The content of the educational material of natural science The cycle	Content of the mathematical material	Types of implementation of inter subject relations
1	Physics	Uniformly accelerated Movement	Linear function, the derivative of a function	related services
2		Movement, interaction of bodies. Electricity	Direct and inverse proportional dependence	related services; follow-up
3		Mechanics	Vectors, coordinate method, derivative, function. The graph of the function	prior, concomitant, and subsequent
4		Optics	Symmetry	related services;
5		Kinematics	Vectors, operations on vectors	related services; follow-up
6	Computer science	The algorithm of the program	Procedure	preliminary, accompanying, subsequent
7	Geography	Image of the earth's surface	The scale of the coordinates on the plane	follow-up

8	Chemistry	The mass, volume, and quantity of the substance. Problems with the mass fraction of the reaction product field.	Equations, percentages	preliminary, related, and follow-up
		Calculations of the mass fraction of impurities for a given mass of the mixture. Solutions. Determination of the formula of a substance by the mass fractions of elements.		

Table 11

Intra subject relationship between mathematics and humanities subjects

№	Subjects of the humanitarian cycle	The content of educational material in the subjects of the humanities cycle	Content of the mathematical material	Types of implementation of intrasubject relations

1	Native language	The name is a numeral. Translation.	Fractions. Adding and subtracting fractions with different denominators. Problem material.	preliminary, accompanying follow-up
2	Literature	Poetry	The concept of the golden ratio	accompanying
3	History	The algorithm	The algorithm	accompanying, subsequent
4	English language	Translation	Problem material	preliminary, accompanying, subsequent
5	Biology	Structure of plants and animals	Fibonacci Numbers; Progressions	related services

Thus, inter subject connections, being realized in the learning process, strengthen the subject-based learning system. This application of inter subject relations shows how it is possible to vary the means and methods of teaching several academic subjects, but not lose the uniqueness of each of them.

Based on the results of the analyses on this topic, we have identified the means aimed at implementing interdisciplinary connections in the process of teaching mathematics.

For many years, great attention has been paid to the problem of intrasubject relations. This is due to the fact that learning based on interdisciplinary connections reflects the relationship between the components of the subject structure of education; forms a holistic perception of the world and cognitive interests, which affects the comprehensive development of the student's personality. Therefore, the interest in the problem of intrasubject relations does not decrease at the present time.

From the analyzed literature, we can distinguish the following tools aimed at implementing inter-subject relationships that can be

used in the educational process:

- issues of cross-curricular content;
- cross-subject assignments;
- inter subject problem situations;
- inter subject texts;
- crossword puzzles of an inter subject nature.

Let's look at each dedicated tool aimed at implementing inter subject relationships in detail. Questions of inter subject content-direct the activities of students to reproduce previously studied in the

different academic disciplines of knowledge and their application in the assimilation of advanced educational material.

For example, the question of inter subject content: what are the sections used for (the golden section)? How is this topic applied in literature and mathematics?

Inter subject tasks-contribute to the identification of students ' abilities, help them think outside the box, and find interesting solutions to educational problems. Interdisciplinary tasks may include topics of two or three academic disciplines.

For example, "mathematics" and "electrical engineering". Construction of a sinusoid, (applicable in electrical engineering).

Inter subject problem situations are the created state of intellectual difficulty for students when they discover that they do not have enough available subject knowledge and skills to solve the task assigned to them, and realize the need for their intra-and inter subject integration.

For example: A

conflict situation-occurs when there is a contradiction between the life experience of students, their everyday concepts and scientific knowledge.

The situation of uncertainty-occurs when students are presented with a task with insufficient or redundant data to get an unambiguous answer.

This means that the occurrence of the most problematic situation is the motivation for the cognitive activity of students.

Inter subject texts-specially compiled inter subject texts are of

great importance in the assimilation of the links between the knowledge obtained by students in the study of various disciplines. Inter subject texts complement the content of the text of the textbook and reveal more deeply the individual issues of the curriculum.

Inter subject crosswords — as a means of implementing inter subject connections in the learning process, I use crosswords of inter subject content, which allow students to consolidate the terms used in several disciplines, to understand the inter subject nature of related concepts.

Thus, the mentioned means of implementing interdisciplinary connections in the learning process are aimed at reproducing, repeating, consolidating, systematizing and applying knowledge by students from different academic disciplines. They provide a combination of reproductive and search cognitive activity of students, carried out under the direct supervision of the teacher.

An integrated lesson can also be used as a means of implementing intrasubject relationships. This type of lesson allows you to solve a number of tasks.

In this Chapter discussed issues such as: identifying the nature of "interdisciplinary communication" based on the analysis of psycho-pedagogical and methodological literature, was conducted a content analysis of definitions of interdisciplinary connections; dedicated classification interdisciplinary connections; the possibilities of interdisciplinary connections in the teaching of a school course of Mathematics, and tools towards the implementation of interdisciplinary connections.

Inter subject connections allow us to identify the main parts of the content of the educational process, to provide for the development of concepts, general scientific methods of educational activity, the possibility of a comprehensive application of knowledge from various subjects in the work of students.

They also affect the composition and structure of academic subjects. Each academic subject is a source of different types of interdisciplinary connections.

Improving the system of diverse interdisciplinary relations

involves improving the ways of their implementation:

- planning of work in the educational process;
- management of the activities of all participants in the educational process;
- effective use of intrasubject relations at conferences, seminars, dissemination of the practice of double lessons with the participation of two or more teachers.

V METHODOLOGICAL FOUNDATIONS FOR THE USE OF INTERDISCIPLINARY CONNECTIONS IN PHYSICS IN A COMPREHENSIVE SCHOOL

Modern physics is developing in close connection with mathematics. At the same time, it is very important that the concepts that are used in mathematics and physics would receive a consistent, mutually complementary interpretation.

Much attention should also be paid to the introduction of a modern mathematical language into physics, in which the basic concepts of symbols of set theory play a leading role. It is necessary that the students have formed the basic concepts and laws, as well as the ability to build graphs, vectors, etc. Since if those knowledge and skills are not formed, students will not be able to assimilate material that relies on exactly what they should already were to know from mathematics.

The interrelation of these sciences is expressed in the interconnection of their ideas and methods, which can be conditionally divided into three types:

1) Physics sets the tasks to create the mathematical methods necessary for their solution, which later serve as the basis for the development of mathematical theory (Newton's theory of differential calculus for solving the problem of the motion of bodies).

2) The developed mathematical theory is used to analyze physical phenomena, which often leads to the creation of a new physical theory (Maxwell's theory of the electromagnetic field), which in turn leads to the development of the physical picture of the world (in this example, electrodynamic) and to the emergence of new physical problems (special theory relativity).

3) Physical theory in its development is based on a mathematical apparatus that develops and improves as it is used in physics (general theory of relativity tensor analysis, quantum mechanics and matrix calculus, elementary particles and group theory)

4) These areas of communication between physics and mathematics are reflected in teaching, and are of a two-way nature. Since not only in physics lessons we apply knowledge from mathematics, but also in mathematics lessons, we remember and rely on the knowledge gained during the assimilation of educational material in physics lessons. In (Table 12), as an example, the implementation of interdisciplinary connections between physics and mathematics in the 9th grade in the study of mechanics is shown.

Table 12

Implementation of interdisciplinary connections in the study of mechanics in grade 9

What is needed from the course of mathematics to physics	What physics gives to mathematics
Vector and operations on vectors Coordinate system Radian measure of angle, the ratio between a radian and a degree Linear function and its graph Square function and quadratic equation Trigonometric function concepts	Examples of vector quantities $(\vec{s}, \vec{v}, \vec{a}, \vec{F})$ and operations on them Plane and spatial Cartesian coordinate systems Solving problems that help the formation of a mathematical language Coordinate equations $x = x_0 + v_x t$ and speed $x = x_{0x} + a_x t$, motion graphics Coordinate equation $x = x_0 + v_{0x} t + \frac{a_x t^2}{2}$, equation trajectory $y = f(x)$ Solving problems

Let's consider the possibilities of interdisciplinary connections

between physics and mathematics on the example of studying the issues of geometric optics in grades 8 and 11 (table 13). Since many basic concepts and knowledge from mathematics are used to study physical phenomena and processes. To build and solve problems, you should apply the already acquired knowledge from mathematics, or relying on this knowledge to study and apply something new.

Table 13

Elements of mathematical knowledge in the study of issues of geometric optics

Geometric optics issues	Elements of mathematical knowledge	Possible place of application of intrasubject connections in the lesson
8 grade		
Reflection of light. Reflection law	Beam, angle, equality of angles, perpendicular (normal)	Study of the law of light reflection. Solving problems
Flat mirror	Axial symmetry	Construction of an image in a flat mirror.
Light refraction. Refraction law.	Beam, angle, ratio of angles in a triangle, sine of an angle in a right triangle.	Study of the law of refraction. Solving problems.
Lens image	Creation of parallel lines, intersection of three lines at a point	Construction of images in lenses. Solving problems.
11 grade		
Huygens' principle.	Correlation of	Proof of the law of

The law of light reflection.	angles in a triangle, similarity of triangles.	light reflection. Solving problems.
The law of refraction of light.	Angle between two mutually perpendicular sides, ratio of angles in a triangle, sine of an angle, tangent of an angle, ratio of tangent of sine of small angles.	Proof of the law of refraction. Solving problems.
Full reflection.	Ratio of angles in a triangle, sine of an angle.	Displays the value of the angle of total reflection. Solving problems.
Thin lens formula. Lens enlargement.	Similarity of triangles, properties of proportions, direct and inverse proportionality.	Derivation of formulas for a thin lens of magnification. Solving problems.

Let's show the possibility of using MPS through the integration of knowledge of mathematics into physics when solving a problem on the law of refraction of light.

Task 1.

How long does it take for a body thrown upward at a speed of 20 m/s to reach a height of 15 m? Can it reach 25 m?

Given:

$g = 10\ m\backslash s^2$

$v = 20\ m\backslash s$

$h_1 = 15\ m$

Solution:

$$S = vt - \frac{gt^2}{2}$$

$$S = vt - 5t^2$$

$h_2 = 25\ m$ Consider the height
$h_1 = 15\ m$

Substituting data

$t - ?$

$25 = 20t - 5t^2$

$5t^2 - 20t + 15 = 0$

$t^2 - 4t + 3 = 0$

$D = 16 - 12 = 4$

$t_1 = \frac{4-2}{2} = 1$
$t_2 = \frac{4+2}{2} = 3$

Consider the height

$h_2 = 25$

Substituting data

$25 = 20t - 5t^2$

$5t^2 - 20t + 25 = 0$

$t^2 - 4t + 5 = 0$

$D = 16 - 20 < 0$ (no roots)

Consequently, there is no such value of t at which the body would reach a height of 25 m.

Answer: $t_1 = 1s. t_2 = 3s.$

Task 2.

The pole is 3 m high, protrudes 50 cm from the water. Determine the

length of the shadow from the pole on the surface of the water and at the bottom of the reservoir, if the angular height of the sun above the horizon is 300 (refractive index of water is 1.33).

Given:

$a = 3\ m$

$b = 3\ m$

$\varphi = 300$

$n = 1{,}33$

$L_1 = OA,$

$L_2 = BK.$

$L_1, L_2 - ?$

Solution:

Angle $O_1OO_2 = 300$ (by the condition), then the angle of incidence

$\alpha = 900 - 300 = 600.$

Shadow on the water

shadow at the bottom

ΔOAO_3 it has $OO_3 = b$, angle $A = \varphi$, angle $O = 900.$

$$L_1 = \frac{B}{tan\varphi}$$

$$L_1 = 0{,}5 \cdot \sqrt{3} = 0{,}85\ m$$

$\frac{sin\alpha}{sin\beta} = n -$ light refraction law

$$sin\beta = \frac{sin\alpha}{n}$$

$$\beta = arcsin\frac{sin\alpha}{n}$$

$\beta = arcsin0{,}64 = 400$

$L_2 = BC + CK, BC = OA = L_1.$

Consider $\Delta CAK,$

it has

$CA = a - b$, angle $C = 900$, $A = \beta$

$$tan\beta = \frac{CK}{a-b}$$

$$CK = (a - b)\ tan\beta$$

$$CK = (3 - 0{,}5)\ tan40° = 2{,}5 \cdot 0{,}83 = 2{,}1\ (m)$$

$$L_2 = BC + CK = 0{,}85 + 2{,}1 = 2{,}95\ (m)$$

Answer: the length of the shadow on the surface of the water is

85 cm, and at the bottom is 2 m 95 cm.

Task 3.

The car moves along a curvature of the road with a radius of 20 m/s with a centripetal acceleration of 5 m/s^2. What is the speed of a car?

Given: Solution:

$R = 30m$ Acceleration is related to the radius of the circle and the linear velocity $a = 5m\backslash s^2$

$a = \frac{v^2}{R}$, where $v = \sqrt{a \cdot R}$;

$v-?$ $v = \sqrt{5\ m\backslash s^2 \cdot 20\ m} = 10\ m\backslash s$

Answer: $v = 10\ m\backslash s$.

Task 4.

The man, evenly lifting the rope, took out a bucket of water from a well 10 m deep. The weight of the bucket is 1.5 kg, the mass of water in the bucket is 10 kg. What work did he do while doing this?

Given: Solution:

$h = 10\ m$ From the work definition:

$M = 1.5\ kg$ $A = F \cdot h \cdot cos\alpha$

$m = 10\ kg$ Where F is the pulling force of the rope, equal to the force of gravity according to Newton's third law:

$g \approx 10\ v\backslash s^2$ $F = (M + m) \cdot g$

$A-?$ Angle $\alpha = 0 (cos\alpha = 1)$ – angle between pulling force and displacement.

We get: $A = (M + m) \cdot g \cdot h$

$A = (1.5\ kg + 10\ kg) \cdot 10 m\backslash s^2 \cdot 10\ m = 1150\ J.$

Answer: $A = 1150\ J.$

In the course of teaching physics and mathematics, it is necessary to regularly draw the attention of students to the fact that mathematics is a powerful tool for generalizing physical concepts and laws. Mathematics is an apparatus for expressing general physical laws and methods of discovering new physical phenomena and facts, and physics, in turn, stimulates the development of mathematics by setting new problems.

Thus, the interdisciplinary connection between school courses in physics and mathematics contains great opportunities for improving the scientific level of teaching each of these disciplines, therefore, the relationship between them is necessary from the very beginning of their study.

Methodical recommendations for the implementation of interdisciplinary connections in a comprehensive school.

In the process of experimental research, it was revealed that 36% of the surveyed students consider the connection between physics and chemistry the most popular, 32% the connection between physics and mathematics, and 16% the connection between physics and biology. It can be concluded that the implementation of interdisciplinary connections in physics lessons is important and will be effective for improving the educational process.

To implement the model of intrasubject connections in the educational topic, it is necessary to analyze the content of the studied topic in order to identify the connecting elements. You should also consider the curriculum, in order to determine the degree of overlap of the content with the content of the studied topic.

Some features should be paid much attention to:

1. Inconsistency of terminology, designations and, in some cases, nuances in the interpretation of concepts. This applies not only to the content of the course of one discipline with the content of another, but also in certain classes, concepts are interpreted in different ways.

2. The role of the studied subject in the formation of students' skills and abilities necessary for related subjects should be properly assessed.

3. When studying a topic, using interdisciplinary communication, you should use the concept formed in the study of other subjects, i.e. repeat, remind.

Recommendations for the effective implementation of lessons with interdisciplinary connections:

1. Provide general orientation of students in the content of the educational topic, as well as check the psychological readiness to study the educational topic on an interdisciplinary basis. At the beginning, students need to be brought to an awareness of the integrated nature of the content of the topic.

2. You should look through the textbooks of those subjects with which you intend to apply interdisciplinary connections in order to identify topics similar in topic. Reveal the general direction of these topics and indicate the purpose of the lesson.

3. When drawing up a lesson outline, you should choose at what stages of the lesson intrasubject connections will be carried out, and in what form they will be presented (tasks, exercises, questions, individual cards, etc.).

4. Apply systems of questions, assignments, educational tasks, which, as a rule, are problematic, heuristic in nature.

5. The most effective use of interdisciplinary connections for problem situations and overcoming contradictions that arise in the educational process, when students are convinced that these contradictions can be resolved by using knowledge from other academic subjects.

6. You should carefully consider the location of the necessary equipment, visual material. For a more rational use of the time allotted for the lesson.

7. The teacher must clearly understand the application of interdisciplinary connections, know well the material that he will tell.

8. Preparation of assignments in which students will develop independence in the establishment of interdisciplinary connections.

9. The use of flexible forms of interaction between participants in the pedagogical process for the implementation of intrasubject connections (holding seminars, conferences, intrasubject written

works, excursions).

Close cooperation of subject teachers is necessary for the implementation of interdisciplinary connections in the classroom. Since a special role in the process of implementing these connections belongs to the formation of general concepts among students on an interdisciplinary basis.

The implementation of interdisciplinary connections ensures the availability of the studied subjects, internal and external continuity and logical consistency at various levels of education.

A general analysis of textbooks allows us to note: many facts and concepts are presented in them repeatedly in different disciplines, and their repeated presentation adds practically little to the knowledge of students. Moreover, often the same concept is interpreted in different ways by different authors, thereby complicating the process of their assimilation.

Often, textbooks use terms that are little known to students; they have few interdisciplinary assignments. Many authors hardly mention that some phenomena, concepts have already been studied in courses of related subjects, do not indicate that these concepts will be considered in more detail when studying another subject.

The forms and methods for the implementation of intrasubject connections can be as follows:

- reliance in the process of studying new material in physics on the knowledge and skills acquired by students earlier in the study of other subjects;
- conducting complex interdisciplinary seminars;
- reading lectures of an interdisciplinary nature;
- solving problems of interdisciplinary content;
- execution of complex experimental works;
- carrying out complex excursions.

Topics of interdisciplinary lectures can be, for example, "Physics and chemistry of the structure and properties of matter", "Science and space", "Physical research methods in natural science and technology", "Modern ideas about space and time."

The problem of intrasubject connections receives a new solution

in the context of differentiated learning. This is due to the fact that the connections between physics and specialized subjects can be realized at a higher level and in other, different from traditional forms.

Thus, in-depth training of students in physics and mathematics in classes of physics and mathematics makes it possible, for example, to form students' statistical representations based on knowledge in mathematics obtained during the study of the topic "Elements of the theory of probability and mathematical statistics". Accordingly, it becomes possible to study in the topic "Molecular Physics" such issues as the probability of an event, macro and micro description of physical systems, average values of physical quantities, the distribution of gas molecules by velocities, distribution of molecules in a force field, the concept of basic classical statistics, the second law of thermodynamics and its static meaning, entropy.

It becomes possible to use differential and integral calculus in the formation (or repetition) of the concepts of speed, acceleration, current strength, work, etc.

Appropriate preparation of students of this profile allows them to form their ideas about symmetry as a general scientific methodological principle. In particular, it is possible to show the manifestation of all aspects of this principle: sameness, equality (molecules and elementary particles, homogeneity of space and time - in physics and equality of figures - in mathematics); analogy (mathematical modeling - in physics, identical equations with different coefficients - in mathematics), etc. In addition, it is useful to establish a connection between conservation laws and the symmetry of space-time and fundamental interactions. In more detail than in the main physics course, one can consider the spatial symmetry of crystal lattices.

The same applies to the principle of correspondence. Students usually get acquainted with its manifestation only in the course of physics, where they are told that classical mechanics is the limiting case of quantum and relativistic, geometric optics is the limiting case of wave. In the classes of the physical and mathematical profile, it

becomes possible to prove that Euclidean geometry is the limiting case of Lobachevsky's geometry, and thereby to show that the correspondence principle is a general scientific principle. Knowledge about general scientific principles can be generalized either in social studies lessons, or at a special interdisciplinary seminar.

The establishment of close interdisciplinary connections between physics and chemistry and biology in the classes of the biology and chemistry profile leads to the need to introduce biophysical and physicochemical material into the curriculum and the content of specific lessons. For example, when studying hydrodynamics, one can consider the flow of blood in the circulatory system, blood pressure; in the study of sound vibrations - the role of ultrasound in the life of animals, the use of ultrasound in biological research, etc.

When teaching students in technical classes and vocational schools, it is necessary to establish interdisciplinary connections not only with general education disciplines, but also with general technical and vocational technical ones. This goal is served by the consideration in the physics course of the material that is basic for the study of special disciplines. For example, issues such as the stability of solids, the structure of solids, heat transfer and thermal expansion, viscosity, plastics, are professionally significant for students in construction schools or classes. The study of general technical subjects "Materials Science", "Theory of Machines and Mechanisms", etc. is based on their knowledge. Therefore, special attention should be paid to the study of these questions in the course of physics.

In addition, in the course of physics, when studying certain laws, it is advisable to consider examples of their application in the future professional activity of students. For example, the study of gas discharges should be accompanied by consideration of their applications such as arc welding, electroerosive processing of parts, electrostatic precipitators.

The links between physics and the professional training of students in solving problems can be effectively implemented.

In the classes of the humanities profile, the interdisciplinary connections of physics with history, social science, and literature come to the fore, since one of the tasks of teaching physics in these classes is to form students' ideas about the role of science, including physics, in the development of society, scientific and technological progress, about the relationship between the development of science, social relations, technology. This problem can be successfully solved only on the basis of the realization of intrasubject connections between physics and history.

Of particular importance is the implementation of interdisciplinary connections in solving the problem of ecological education of students. So, when studying alpha-beta and gamma radiation, their effect on the human body is considered, when studying the material on the maximum absorbed dose of radiation, the processes caused in the body by ionizing radiation, the body's resistance to radioactive radiation, the maximum permissible dose of radiation, radioactive contamination of the environment are discussed and protection against radiation, safety measures during the operation of nuclear power plants, etc.

Solving experimental problems helps students to comprehend and understand the studied pattern deeper and more fully, since it shows it in action in a completely concrete setting, where each of the quantities included in the pattern appears before the students quite realistically and in real-life relationships (Appendix 2).

Excursions as a form of study have become firmly established in the educational process of physics. Excursions teach students to observe the phenomena, processes occurring in nature and in production, in their interconnection and interdependence, to better understand the importance of science in the development of technology. For example, an excursion to a river, where students can measure current speed, stopwatch water flow and flow rate. You can pay attention to the dependence of the thermal conductivity and heat capacity of various soils on moisture, show the influence of the color and structure of the soil on its radiation absorption and radiation properties, and introduce you to the change in these properties by

mulching the soil. In winter, students can observe how winter crops and trees are protected from freezing, measure the depth of the snow cover, the temperature of snow at the soil surface and on the horizon.

Excursions bring the study of physics closer to life, contribute to the development of interest in the material being studied, acquaint with the phenomena of nature and modern technology, and help students in choosing a profession.

Thus, the implementation of interdisciplinary connections can be carried out in various ways. In our work, we considered one of the most effective ways, such as solving applied problems from related disciplines, allowing students to demonstrate interdisciplinary communication from different school disciplines

CONCLUSION

It is no secret that innovations in the development of mathematical science are a priority for all spheres of society. The process of Information Science and computerization, the practical application of which is growing day by day, has also widely covered the field of Education. Specific evidence for this can be called the analysis of state documents, which in the introductory part of the work showed in the description of the relevance of the research topic. This trend has not bypassed the process of teaching mathematics in general education institutions, i.e. secondary schools. The use of special programs for interdisciplinary communication in teaching the topic of interest analyzed in the research work gives a positive effect to varying degrees. We hope that the continuation, replenishment and development of this emerging trend will give even greater results in the future than today.

The methodology of teaching mathematics is part of the system of Pedagogical Sciences. Depending on the specifics of the discipline, the mathematics course cannot be completely replaced on a computer basis. For example, the development of students ' abstract thinking through axioms, theorems, and their proofs should be carried out in traditional ways. Only when studying certain topics and chapters can you turn to computer technology. Informatization of the education system and further development of problem-solving competencies is a new step in the educational system through the introduction of special programs in all subjects into the wider educational process. In this regard, the actual thematic goal of interdisciplinary communication is to expand students ' horizons, increase interest in mathematics, improve cognitive communicative competence and information technologies of learning.

The main goal of using new pedagogical information and communication technologies in teaching mathematics is to help students in the educational process. These purposes are served by such products as training programs, electronic textbooks to support lectures, verification programs, and animation programs. During the

implementation of the work, the following works were carried out:

- the theoretical foundations of the implementation of interdisciplinary communication in teaching mathematics to students in general education schools have been determined;
- approval of the content of reports on the topic of interest and methods of teaching it through special programs;
- the principles of building interdisciplinary communication are defined;
- methods of applying the capabilities of special programs through interdisciplinary communication of students in mathematics in general education schools have been developed and tested during the lesson.

Currently, the training of highly qualified specialists who are ready to solve complex problems that meet the requirements of the time is one of the directions defined by the social order of society. It requires a set of personal qualities, worldview, intellectual and professional training, a certain social cohesion and the ability of scientific and professional search for further replenishment of their knowledge and qualifications. Therefore, for each mathematical specialty, there is a need to clarify the requirements for mathematical, pedagogical and psychological training.

In the course of the research, a survey was conducted in two areas: one was among schoolchildren, and the other was among schoolteachers in order to get the opinion of subject teachers.

The subject «Optional extracurricular activities in mathematics» is taught as an elective component in the curriculum of the specialty 6B01501 - Mathematics (education) of E.A.Buketov Karaganda University. With in the frame work of this discipline, students are tested on special programs used in the teaching of mathematics in different areas. One of those works is a test.

Thus, the modern concept of interdisciplinarity of disciplines of the natural and mathematical cycle directs teachers to the systematic interaction of academic disciplines, the active implementation of interdisciplinary interaction in the content, methods and forms of Organization of training, extracurricular work, the widespread

introduction of integrated lessons, elective courses that combine knowledge from various scientific and practical fields into the teaching practice.

The main result of the work performed is the methodology of teaching interest topics in secondary schools and the use of this methodology. In this paper, instructions were given for using the programs MS Excel, MatCad, and MatLab and their capabilities in working with mathematical objects. These programs have shown their effectiveness in building graphs, even if they provide great benefits and optimal use when studying movements, the beauty of the project's image.

The accuracy and validity of the research results on the topic was ensured by the theoretical and methodological principles in accordance with the requirements, the use of methods in accordance with the research topic, the pedagogical expediency of experimental and pedagogical research programs, the summing up of the results of initial and final indicators, the effectiveness of the proposed methodology, and its implementation in the educational process. Pedagogical analysis of regulatory documents, scientific literature, materials of current publications and the ongoing progress in society on the issue under consideration was the basis for the rational and optimal use of special programs in teaching the topics of interest.

Thus, summing up the materials, practice shows that interdisciplinary connections in school teaching are a real reflection of the integration processes taking place in the life of Science and society today. These connections play an important role in improving the practical and scientific-theoretical training of students. Generalization makes it possible to apply knowledge and skills in specific situations, in educational and extracurricular activities, when considering individual issues in the future industrial, scientific and social life of high school graduates. With the help of interdisciplinary connections, the tasks of teaching, developing and educating students are not only solved at a qualitatively new level, but also laid the foundation for a comprehensive approach, vision and solution of complex problems of real reality. Therefore, interdisciplinary

connections are an important condition and result of a comprehensive approach to teaching and educating students.

The model of the lesson plan for the updated content of Education has also changed, and new requirements have been introduced. Within the framework of our chosen topic, we have dedicated a short-term plan for one lesson to the topic "percentages" in accordance with the conditions of this updated educational content. In this paper, we have listed the analyzed stages of the lesson, and in addition, we have presented a detailed short-term plan.

Based on the results of theoretical and practical research, in order to improve the methodology for using interdisciplinary communication in teaching subjects of interest in mathematics in general education secondary schools, the following recommendations can be made:

1) analysis and consideration of materials in this field in each subsequent new academic year, taking into account the need for effective use of special programs;

2) individual consideration of special programs in mathematics at special seminars, conferences, forums organized to improve the methodology of subject teachers;

3) special organization of meetings with teachers of mathematics and specialists in the field of Information Technology on a specific topic and analysis of existing difficulties for teachers.

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Appendix 1

Are you satisfied with the implementation of interdisciplinary communication in teaching mathematics?

1. Is there a need to use special programs in the school mathematics course?

A) Yes

C) No

C) Your Opinion_____

2. Do they use of special programs in the learning process have a positive impact on understanding the content of the topic?

A) Yes

C) No

C) Your Opinion_____

3. What types of special programs are used in the school?

_____

_____

4. Can you name the visual effects used on the topics «equations and inequalities»?

_____

5. Are you satisfied with the lessons conducted using special programs?

A) Yes

C) No

C) I find it difficult to answer

_____

6. Can you name the advantages and disadvantages aspects of special programs?

_____

7. Do special videos affect learning outcomes?

_____

A) Yes

C) No

8. Is there a specially equipped math class in the school?

A) Yes

C) No

9. Can the teachers fully use the capabilities of special programs in the teaching proses?

A) Yes

C) No

10. Your opinion on informatization of the educational process.

-

Appendix 2

Do you use special programs and their capabilities in the learning process?

1. Short information about yourself: (full name, full name of the school)

2. What type of traditional method did you use to explain the topic «equations and inequalities»?

3. Do you use the capabilities of special programs in addition to traditional methods in mathematics lessons?

4. Does the school have a specially equipped math class?

A) Yes

C) No

5. What special program do you use in your subject(name)?

6. Do e-learning tools have a positive impact on learning outcomes? (personal opinion)

7. Are all the opportunities for teaching using special programs created in modern schools?

8. Your recommendations for using special programs in the teaching process:

9. Did the guidelines on special websites help you during your training?

10. Your own opinions on special computer instructions and programs: (advantages, disadvantages)

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