REPUBLIC OF AZERBAIJAN

On the rights of the manuscript

ABSTRACT

Of the dissertation for the degree of Doctor of Sciences

THEORETICAL AND METHODOLOGICAL ISSUES OF PROBLEM-SOLVING TRAINING IN THE SECONDARY SCHOOL MATHEMATICS COURSE (for grades V-IX)

Speciality: 5801.01 – Theory and methodology of teaching and education (Methods of teaching mathematics)

Field of science: Pedagogy

Applicant: **Mubariz Khasay Asadov**

Baku – 2022

The work was performed at Azerbaijan State Pedagogical University, Mathematics and its teaching technology department.

Scientific consultant: doctor of pedagogical sciences, professor
Azadkhan Safarkhan Adigozalov

Official opponents: doctor of physical and mathematical sciences, professor
Mammad Hagverdi Yagubov

doctor of pedagogical sciences, professor
Abulfat Gulam Palangov

doctor of pedagogical sciences, professor
Humeyir Huseyn Ahmadov

doctor of pedagogical sciences, professor
Shahin Taghi Taghiyev

GENERAL CHARACTERISTICS OF THE THESIS

The topicality of the subject and literature review. The economic and military strength of any state is directly related to its education system. The development of the level of education is formed through the effective and purposeful use of direct human capital.

After the declaration of its independence, the Republic of Azerbaijan began to carry out fundamental reforms in the field of education, like in many other areas. The "Education Reform Program of the Republic of Azerbaijan" approved by the decree of the nationwide leader Heydar Aliyev in 1999 set important and responsible tasks for science and education workers.

In recent years, a strong regulatory framework has been created in our country to bring the quality of general education in line with European standards. Relevant documents[1][2] on education of the Republic of Azerbaijan specify the goals and directions of implementation of the tasks. It is intended to ensure the sustainable development of students, to provide them with knowledge and skills necessary for independent living taking into account their learning interests, potential opportunities, physical health.

Today, the level of students in general education schools is determined by the approved learning outcomes for the relevant levels of education and content standards for subjects.[3] The formation of concepts in content standards and the relationships between them are closely related to the concept of quantity. The concept of quantity, their measurement and the content of functional dependencies between quantities are carried out mainly by solving practical problems taken from real life. Problem solving plays a special role in the formation of mathematical knowledge. In modern times, science

[1] Azərbaycan Respublikasında ümumi təhsiln Konsepsiyası / – Bakı: – 2006, – 460 s.
[2] Təhsil haqqında Azərbaycan Respublikasının qanunu / – Bakı: Hüquq, – 2009, - 20 s.
[3] http://edu.gov.az/upload/file/ Təhsil pilləsinin dövlət strandartları və proqramları.

and technology are developing rapidly. There is not any line of development that fully covers the quality of training. Some of the problems that were topical in the researches conducted years ago are still relevant today and will be topical in the future. This means that there is no end point in the development of science. Therefore, the study of theoretical, methodological and practical problems has always been in the forefront of attention at any stage of problem-solving training.

These requirements and directions make it necessary to apply new approaches in the teaching of mathematics. According to the requirements of the content standards of mathematics education at the secondary education level, specific directions are envisaged for the development of students' knowledge and skills on the subject of “Mathematics”.

Here, students' abilities like making logical judgments using measurement and calculation tools, translating theoretical materials into mathematical language using mathematical symbols and vice versa, solving problems of different types based on the dependence between quantities, understanding the properties of plane and spatial figures and applying them in the solution of practical problems, coordinating the lines of content in the solution of problems related to proof and construction and etc. are considered.

The role of mathematical education in the formation of these skills in the learning process is indispensable. Training is such a complex process that it is impossible to be satisfied with any achieved result. In order to improve the quality of mathematics education, it is necessary to constantly reform the relevant programs and textbooks. This process has always been carried out in stages. There were no serious problems with the introduction of content lines in the traditional mathematics textbooks – “Mathematics”, “Algebra”, “Algebra and the beginning of analysis”, “Geometry”. However, in the Mathematics textbooks written on the basis of the curriculum, it is especially important to provide five lines of content, to ensure their intradisciplinary and interdisciplinary integration and to develop practical issues related to them.

Reforms in the education system have been confirmed as a complex process by the scientists and relevant researches have been conducted to minimize problems in this process. Although the change of curricula and textbooks in mathematics in secondary schools is a requirement, this transition has not always been unequivocally welcomed by pedagogues and specialists.

For example, in the 70s and 80s of the last century, education in the former Soviet Union was constantly reformed, and the results were always analyzed and discussed at a high level.

Thus, in 1969, 1977 and 1982, programs and textbooks were changed and redesigned to improve the quality of mathematics education. For five years (1978-1982) in the journal "Mathematics at school" famous Soviet mathematicians A.N.Kolmogorov, V.C.Vladimirov, L.S.Pontryagin, A.N.Tikhinov, L.V.Kantorovich, C.L.Sobolev, A.D.Alexandrov, professors V.G.Boltyansky and A.N.Markushevich published a number of articles on the teaching of mathematics in the secondary school. The interest and participation of prominent mathematicians in the improvement of secondary mathematical education was highly appreciated by the public.[4]

Being one of the most important subjects taught in secondary schools, it plays an exceptional role in the formation of students' mathematical logical thinking, judgment and comprehension skills. The inclusion of mathematics in the entrance exams held by the State Examination Center for all groups in Azerbaijan can be considered as one of the main factors confirming the above-mentioned fact.

The interrelationships of the main learning outcomes, interdisciplinary relationships, content and activites complement each other in the teaching process, forming a complete system.

The general directions of the characteristic features mentioned in the mathematics subject curriculum of the secondary schools of the Republic of Azerbaijan have been analyzed and substantiated in detail. The importance, goals and objectives of the subject of

[4] Столяр, А.А. Педагогика математики / А.А.Столяр. – Минск: Выш. шк., – 1986. – 410 с.

mathematics have been generally mentioned in the curriculum. It has been stated that the mental development, the formation of personal qualities, the state of modern human life and the world culture are inextricably linked to mathematics.[5]

If we analyze the above-mentioned goals and objectives separately, it is undeniable that mathematics are connected not only with the exact sciences, but also with the humanities. Some of the aphorisms made by eminent philosophers and scientists in ancient times about the science of mathematics are still relevant today. Thus, ideas, such as B.Napoleon's "The power of mathematics and the power of the state in each country are parallel to each other", M.V.Lomonosov's "The right hand of physics is chemistry, and mathematics is his eye", N.I.Lobachevsky's "Mathematics is the language of all sciences", A.Markushevich's "A person engaged in mathematics from childhood develops attention and consciousness, strengthens his will and becomes stubborn", etc. are still relevant today.

If we compare the goals and objectives of the modern mathematics curriculum with the phrases we mentioned, we can conclude that they are similar in content.

Eminent Russian poet A.S.Pushkin praised mathematics and said: "Beauty in music and poetry is also present in mathematics".

Thus, the formation of students' mathematical knowledge and skills is realized through problem solving in the secondary school course. The place and role of the problem in the teaching of mathematics has always been one of the most pressing issues. The research is mainly dedicated to the analysis of theoretical, practical and methodological problems in secondary school mathematics textbooks and in the structure of scientific-methodical aids related with them.

[5] Azərbaycan Respublikasının ümumtəhsil məktəbləri üçün riyaziyyat fənni üzrə təhsil proqramı (kurikulumu) (V-IX siniflər) / – Bakı: – 2018. – 18 s.

In accordance with the “Education Reform Program of the Republic of Azerbaijan”, the development of new textbooks and teaching aids for secondary schools has begun.

It is true that some researches have been conducted by experts on textbooks and teaching aids. For instance, E.A.Mammadova performed a dissertation entitled “Development trends of secondary school textbooks in Azerbaijan (1991-2007)” under the supervision of Professor Ajdar Aghayev. In this work, the development path and directions of textbooks for secondary schools have been analyzed and comparisons have been made for different periods.

The main results of research, usually conducted by pedagogues and psychologists, have been carried out almost exclusively in mathematics. The conduct of research and pedagogical experimentation in many cases on the subject of mathematics is explained by the close connection of mathematics with the leading and other subjects. Psychologists S.H.Rubinstein, L.S.Vygodsky, V.V.Davidov, A.B.Petrakov, V.P.Zinchenko, B.G.Ananyev, A.S.Bayramov, A.A.Alizadeh and others, pedagogues M.N.Skatkin, M.A.Danilov, G.U.Shukin, M.U.Makhmutov, A.B.Zankov, N.M.Kazimov, B.A.Ahmadov, M.M.Mehdizade, H.B.Ahmadov, A.H.Pashayev, F.A.Rustamov and others, mathematicians-methodologists Y.M.Kolyagin, A.A.Stolyar, B.A.Aghayev, S.S.Hamidov, A.S.Adigozalov, A.M.Mammadov, M.S.Jabrailov, M.C.Mahmudov, A.G.Palangov, S.A.Feyziyev, T.M.Aliyeva, A.A.Guliyev, S.I.Tumanov, M.B.Balk, L.M.Friedman, E.N.Turetsky, E.F.Danilov, V.Q.Boltyansky, A.M. Markushevich, N.I.Vilenkin and others conducted researches in connection with the development of logical and mathematical thinking of students in the learning process.

In the researches of A.G.Palangov, the issues of implementation of modern teaching methods related to computer technology in teaching the elements of the geometry content line in the secondary school course have been considered, the stages of organizing and applying computer in the teaching of the geometry course of the secondary school have been studied.

The works of M.M.Ashurov, B.S.Jabrailov, F.S.Suleymanov, M.T.Rzayev, S.J.Jabrayilzade, M.J.Abdulkarimov and others can be included in the researches on the methodology of teaching mathematics in Azerbaijan after the 90s of the last century.

None of these studies specifically addresses the theoretical and methodological problems of problem-solving training.

At the same time, researches on the education system in the world and in Azerbaijan, the problems and prospects of mathematical education in modern times, the role and importance of mathematical education in the modernization of education have been conducted mainly from a pedagogical point of view.[6]

Some of these studies are purely related with problem-solving. However, none of these studies comprehensively explores the theoretical, practical, and methodological problems of problem-solving training.

In this regard, the topicality of the research topic can be justified for the following reasons:

–the role and importance of problem-solving training in the formation of students' knowledge and skills in the secondary school mathematics course;

–identification of theoretical and methodological issues of problem-solving training in textbooks and methodological literature written on the basis of new curricula, comprehensive identification of ways to overcome them;

–analysis of relevant pedagogical and scientific-methodological cases affecting the statistical indicators of the examination results on the subject of mathematics of the State Examination Center;

–the need to solve problems in the formation of new approaches to the goals and objectives of education and the

[6] Махмудов, М.Д. XXI век и математическое образование: проблемы и перспективы // Вистник Черкаського Университету. Серия: Педагогични науки, Черкаси, – 2010. Випуск 181, Частина II , – с.63-68.

implementation of ways to improve practical materials in textbooks, etc.

Changes in standards and the application of modern approaches to the secondary school mathematics have caused some problems. Thus, the inclusion of some topics previously taught in higher education in the secondary school mathematics course and the lack of methodological literature related to the teaching of these topics create certain difficulties. The inconsistency of some topics included in the mathematics textbooks of the secondary schools without undergoing the pedagogical experiment and analyzing the results of statistical data related to the entrance exams of the State Examination Center, resulted in certain objective problems. One of the main problems is that students have little or no problem-solving skills. Experience shows that sometimes, even students who score high in the entrance exams have difficulty with solving problems. The recent changes in the content of the entrance exam questions conducted by the State Examination Center and the results of the examinations also confirm these facts. The formation of problem-solving skills in students, the expansion of opportunities for interdisciplinary communication, the solution of problems of concrete content taken from practical life are being realized in the secondary school course. For this reason, we considered it advisable to study the theoretical, practical and methodological problems of problem-solving training in the mathematics course of V-IX grades of the secondary school at the level of doctoral dissertation. Taking it into account, the study of theoretical and methodological issues of problem-solving training in the secondary school mathematics (for grades V-IX) can be considered relevant to the requirements of the time.

The object of the research is the process of teaching mathematics in V-IX grades of secondary schools.

The subject of the research is the didactic ways and means that allow to solve theoretical and methodological issues of problem-solving training in V-IX grades of the secondary schools.

The aim of the research is to scientifically and pedagogically identify the theoretical and methodological issues of problem-solving

training in V-IX grades of the secondary schools, to substantiate the proposed theory experimentally by providing their solutions in the form of a methodological system.

Research hypothesis – methods of solving theoretical and methodological problems of problem-solving training in the secondary school mathematics course can be realized if we take the following into account:

1) If students freely answer the question why they study mathematics and what they should study;

2) If students define the place and role of mathematics in the development of society;

3) If the teacher is able to apply traditional and modern teaching technologies appropriately in the learning process through analyzing their similarities and differences;

4) If the effectiveness of problem-solving training in the development of logical and mathematical thinking of students and ways of its development are determined;

5) If the concept of the problem and methods of its solution are provided in the mathematics textbooks of V-IX grades and existing problems between them are eliminated taking into account the connection between theory and practice;

6) If the existence of intradisciplinary and interdisciplinary relations in problem-solving training, their place in textbooks and methodical literature is determined;

7) If the students' independent activity, their respect for each other's opinions and ideas in the process of training and the results obtained during the exchange of information are freely expressed;

8) If the mathematical concepts, definitions are scientifically and methodically included correctly in the training process and the development of students' mathematical speech is maintained;

9) If the teacher, who is considered the “driving force” in the training, constantly works on himself/herself and effectively uses traditional and modern teaching methods and techniques;

Based on the above-mentioned hypotheses, the following objectives have been identified in the study to achieve the aim of the research:

1. To review the pedagogical, psychological and methodological literature related to the theoretical and methodological status of problem solving training in the secondary school mathematics course.

2. To identify theoretical and methodological problems in teaching by solving problems in textbooks and teaching aids written on the basis of traditional and new curricula on mathematics for V-IX grades of the secondary schools;

3. To study the situation in the secondary schools on the stated problem, to analyze the statistical results given by the State Examination Center on the subject of mathematics in the admission process, to identify the reasons for solving the above-mentioned problems;

4. To Identify appropriate directions and stages to minimize the theoretical and methodological issues of problem-solving training for grades V-IX;

5. To make a comparative analysis of theoretical and methodological problems on the mathematics program (curriculum) and textbooks of V-IX grades for separate classes (for traditional and new textbooks);

6. To associate the theoretical, practical and educational significance of problem-solving training for V-IX grades with real the life and develop a system of problems according to the program for the relevant grades;

7. To examine the state of intradisciplinary and interdisciplinary integration in the teaching of mathematics in the classroom, identify ways to increase the opportunities for integration to increase the effectiveness of training;

8. To identify existing problems in the parallel placement of content lines in the mathematics course of V-IX grades and show ways to eliminate their causes;

9. To determine the directions of developing students' logical and mathematical thinking in learning by solving problems in V-IX grades;

10. To determine the creative and developmental abilities of students through problem-solving in the learning process, to achieve ways to increase its development;

11. To compare the obtained general results related to the research with other researches found in traditional textbooks and methodical literature;

12. To test the effectiveness of the proposed methodological approach with the help of pedagogical experiment.

The methodological basis of the research is a set of principles, methods, theoretical and practical provisions applied in order to study, understand and objectively evaluate pedagogical facts and processes within the cognitive theory of dialectics.

The methods of research are theoretical and practical analysis, observation, interview, analysis, synthesis, comparison, questionnaire, pedagogical experiment, mathematical-statistical methods, etc.

Scientific novelty of the research. Theoretical and methodological issues of problem solving (V-IX grades) in mathematics in the secondary schools of the Republic of Azerbaijan for the last 30 years have been comprehensively studied and the directions of conformity of the obtained results to the modern teaching process have been determined. Modern approaches to training have been compared with traditional training, ways to improve the quality of problem-solving training in the secondary school, various methods of solving textual problems proposed in traditional and curriculum-based “Mathematics” textbooks and “Methodological aids” have been studied, solutions, different solution models of mathematical problems related to the disciplines “Physics” and “Chemistry” have been developed and an original method for solving applied problems related to the integration of mathematical problems with the problems related to other disciplines has been proposed.

The theoretical significance of the research is the comprehensive presentation of theoretical and practical issues of problem-solving training in the mathematics course of V-IX grades, elimination of the mentioned problems, teaching in connection with other subjects, enrichment of mathematics and related subjects with new scientific provisions. The connection of theoretical and practical materials has been shown in the solution of real and life-related problems. Theoretical and practical materials put forward in the dissertation create new opportunities for the activities of secondary school teachers, researchers engaged in this field, the presented scientific-methodological ideas and provisions contribute to the development of didactic theory.

The practical significance of the research is to improve the content and quality of mathematics education by correctly solving the theoretical and methodological issues of problem-solving training in the secondary school mathematics course. The presented methodical system can be used in the development of existing mathematics programs, textbooks and teaching aids for V-IX grades, methodical aids and recommendations for teachers.

Main propositions for defending the thesis:

−there are wide opportunities for corporate teaching of theoretical and practical issues in the teaching of mathematics in the secondary schools and this allows students to develop life skills;

−development of a system of theoretical and developmental issues allows to expand interdisciplinary relations by developing students' mathematical and logical thinking;

−the consistent and methodical incorporation of the five content lines in the mathematics textbooks correctly for each class serves interdisciplinary integration by creating conditions for the effectiveness of teaching;

−the application of a system of practical and developmental issues, the content of which is taken from real life, along with directing students to research-oriented research, forms in them the features of confidence, tolerance, principledness in solving real problems;

–integrated analysis of issues related to medicine, economics, history, physics and chemistry in the textbooks written on the basis of the curriculum creates the idea of the formation of a “single science” in the students and leads to the orientation of their objective worldviews;

–the application of theoretical materials in the solution of practical problems and the acquisition of new regularities by students in the process of solving practical problems increases their self-confidence, interest in solving developmental and applied problems;

–the realization of the dependence of the quantities involved in the process of solving the problem with different models, contingent upon the number of objects involved in the problems related to the movement, allows students to develop spatial imagination;

–if the movement around a circle, the quantities that characterize it, the concepts of physics are studied in a single system, the fact that some mathematical problems are similar to the problems of physics leads to the visual formation of interdisciplinary integration in students;

–The methodical system, which provides the elimination of theoretical and practical issues in the process of problem-solving training, enhances the scientific and pedagogical activity of the teacher, expands the application of modern approaches in teaching, objectively assesses the connection of mathematics with other subjects in the secondary school, identifies the difficulties with regard to general development of the student and ways to overcome them.

Stages of research. In the **first stage** of the research, textbooks, methodological aids related to the teaching of mathematics in secondary schools of the Republic of Azerbaijan, the content of research work on this issue have been reviewed on the basis of experience gained by the researcher during more than 30 years of pedagogical activity in secondary schools, colleges and universities. The status of the problem in the curriculum, textbooks and methodical literature published during the former Soviet Union, its main theoretical and practical problems have been analyzed and

its connection with modern teaching and technologies related to the teaching of mathematics in the secondary school has been considered.

In the **second stage** of the research, the questions of identifying theoretical and methodological issues of problem-solving training (for grades V-IX) in the secondary school mathematics course and the ways to overcome them. The current pedagogical, psychological and scientific situation has been analyzed implementation of mathematics training through problem solving.

The new mathematics textbooks provide a comparison and analysis of problem-solving with other traditional textbooks. In order to comprehensively identify theoretical and methodological problems related to problem solving, along with mathematics textbooks, researches of mathematical methodologists on this problem have been studied, ideas and considerations suitable for modern learning technologies have been taken into account for the next stages of research.

In the **third stage** of the research, a methodological system has been developed to eliminate the existing complications of problem-solving training in the secondary school mathematics course. Intradisciplinary and interdisciplinary relations, as well as relationships between mathematics and other subjects, including physics, chemistry, etc. have been explored by grade. At this stage, the proposed methodological system, its effectiveness in the learning process, the validity of the proposed theoretical and practical considerations have been tested experimentally.

In the last stage of the research, the obtained theoretical and practical results, the outcomes of the experiment have been analyzed again, the provisions aimed at improving the quality of problem-solving training in the secondary school mathematics (grades V-IX) have been tested in the secondary school mathematics training, as well as the opportunities of considering them in other researches have been identified.

The objectivity of the **research results** is provided by the theoretical and methodological substantiation of the problem, its

construction based on modern psychological-pedagogical and methodological facts, the results of the pedagogical experiment confirming the quality of the main provisions of the dissertation, positive assessment by teachers and other participants.

Approbation of research. The dissertation was prepared at the "Mathematics and its teaching technology" department of Azerbaijan State Pedagogical University.

30 articles and a monograph of 595485 characters has been published on the results of the research. The results of the work have been presented at 5 International and 5 Republic conferences. 7 of these articles have been published in foreign countries, including one in a journal included in the Web of Science database.

The structure of the dissertation comprises an introduction, four chapters, analysis of the pedagogical experiment, conclusions and recommendations and a bibliography. Dissertation consists of 320 pages and 506140 characters. Title page consists of 435 characters, table of contents 4474 characters, introduction 13 pages 23358 characters, Chapter I 54 pages 77176 characters, Chapter II 54 pages 123075 characters, Chapter III 54 pages 116464 characters, Chapter IV 54 pages 115485 characters, pedagogical experiment and its results 9 pages 11915 characters, the general results and recommendations of the study 7 pages 12475 characters.

THE MAIN CONTENT OF THE STUDY

The introduction substantiates the relevance of the topic, explains the object, subject, purpose, hypothesis, objectives to achieve the goal, methodological basis, research methods, scientific novelty, theoretical and practical significance, propositions for defending the thesis, application and approbation.

The **first paragraph** of the **first chapter** of the dissertation **"Scientific and pedagogical bases of theoretical and methodological issues of problem-solving training in secondary school mathematics"** entitled **"Theoretical and methodological issues of mathematical problem-solving training"** analyzes the

psychological, didactic and methodological issues of problem solving.

Through problem-solving and by applying modern pedagogical technologies, the teacher must not only provide students with new scientific knowledge, but also develop their cognitive activity, independent thinking and the ability to logically analyze the obtained information.

There are special features of the inclusion of mathematical concepts in the secondary school mathematics course. The application of different psychological concepts in training plays a fundamental role in the construction of different theories.

It is widely used in the improvement of teaching mathematics on the basis of modern psychological and didactic theories, in the coordination of different content lines and in interdisciplinary integration. There are theoretical and methodological problems at every stage of it.

Theoretical and practical problems of problem-solving training in mathematics are inseparable and must be solved in a complex way. Since the functions of problem-solving training are part of the learning process, the problems that exist here cannot be solved by mathematical knowledge, skills and habits alone. The concept of problem in teaching mathematics can arise at different stages of the pedagogical process, and the problematic situation can take different forms for effective teaching.

Mathematical concepts and their inclusion in a certain sequence, their logical and pedagogical system is considered one of the main stages of conditional learning.

The components of a training problem can be identified as follows:

−creation of a problematic situation and problem statement;

−fulfillment of the conditions characterizing the problem;

−solution of the stated problem;

−substantiation of the accuracy of the obtained solution and generalization of the problem;

–application of new theoretical knowledge in the process of solving specially selected problems;

–completion of the work.

Psychologists N.A.Leontev, C.L.Rubinstein, P.Y.Galperin, J.Bruner, D.N.Bogoyavlensky, N.A.Menchinska and others provided an analysis of problem-solving opportunities in the training process. The dissertation compares the theoretical and methodological problems mentioned by pedagogues and psychologists with modern approaches to problem solving.

The second paragraph of the first Chapter is entitled **"Research on problem-solving training in the secondary school mathematics"**. The work of domestic and foreign researchers on the solution of the problem has been considered here. The use of similar concepts such as "teaching problem", "didactic problem", "mathematical problem" in the acquisition of theoretical and practical materials in the teaching of secondary school mathematics, the development of students' mathematical and logical imagination, the formation of their objective worldview.

Problem in teaching mathematics and its solution creates ample opportunities in the formation of students' personality. The mathematical activity of the student, the formation of his knowledge, skills and habits depends on the content and structure of the problem used in training. In order to achieve the goal set in the training process, it is important to present the issues from a didactic point of view. Extensive research has been conducted in the last century on the problem and its role as a leading tool in education. The works of A.M.Pishkalo, A.A.Stolyar, A.Y.Kolyagin, L.N.Skatkin, R.S.Cherkasov, S.I.Schwarzburg, D.Poya, L.M.Friedman and others are among these researches.

D.Poya called the existing problems in the secondary school course as "mathematical problems", analyzed the psychological and pedagogical problems during the solution of the problem and showed the ways to eliminate them.

Y.M.Kolyagin argued that “mathematical problems are a key tool in teaching and student’s development” and used the term “teaching problem”.

In his doctoral dissertation entitled “Logical problems of teaching mathematics, A.A.Stolyar called the pedagogical problems arising during the modernization of the methods used in teaching mathematics the logical problems of teaching mathematics.

In his researches, S.S.Hamidov considers it conditional to classify the problems as “arithmetic”, “algebra”, ‘geometry”, “mathematical analysis”.

A.S.Adigozalov notes in his research that the problem is a means of discovering the meaning of mathematical concepts. The analysis of the mentioned researches has been carried out here.

The third paragraph of the first chapter entitled **“Classification and application of training methods in teaching mathematics”**, considers the classification, role and application of training methods used in solving the problem. Ways of using training methods in understanding the content of the problem and the functions of the relationship between the methods in the solution process have been analyzed.

This is how the mathematician-methodologist D.Poya assesses the understanding of the problem. “The student must understand the problem. He must not only understand, but at the same time should be willing to solve it. If the student does not understand the problem or is not interested in it, it is not always the student's fault. The issue should be chosen in such a way that it is neither too difficult nor too easy, it should be natural and interesting. The student should feel that it is natural and interesting as soon as possible”.

These are included in a comprehensive methodological system. The methodological system of training considers the goals, content, methods, means and forms of training. Various training methods are used to understand the content of the problem and solve it. The main methods in the study of mathematics are observation and practice, comparison and analogy, generalization, abstraction and concretization, induction and deduction, analysis and synthesis,

problem-based learning methods, etc. Research methods are also used as teaching methods.

In mathematics training, the student's creative activity is realized primarily by the method of observation. Observation and "taking notice" cannot be equated in the learning process, and these are different concepts.

Methods of analysis and synthesis are applied together in the introduction of mathematical concepts, in the stages of proof and in the solution of some practical problems. Analysis and synthesis are considered to be important methods of learning in mathematics training and are widely used in proof processes. Analysis and synthesis methods are used together, regardless of the solution methods used to solve some textual problems. Intuition, analogy and their special cases in the teaching of mathematics have also been analyzed in the solution of specific problems.

The fourth paragraph of the first chapter, "**Mathematical problem as a tool for developing students' thinking"**, examines the relationship between the problem and the components of thinking. The close connection between the learning system and the cognitive development of the student is based on a certain regularity. As a result of research conducted by psychologists and pedagogues, the question of which thinking belongs to purely mathematical thinking is still an unresolved problem. Forms of thinking are used in one way or another in the formation of any mathematical concept.

When solving a mathematical problem, it is advisable to study the components of logical and mathematical problems in parallel. The realization of this is based on thinking, and this is usually done in problem solving.

To ensure the development of mathematical thinking, concepts should not be formally included, all parts and features of abstract concepts should be specified, concrete-inductive and abstract deductive methods should be used.

Students' development is closely related to the main components of mathematical thinking. Unlike traditional teaching, modern education requires students to work more actively and

independently. The new textbooks provides advantages and disadvantages of reducing theoretical material and giving priority to practical work. These issues have been analyzed here. Operational and non-operational forms of thinking, their role in the introduction of mathematical concepts have been noted. In operative thinking the concrete model of object has been considered. In non-operative thinking, the model of an object (event) is perceived on the basis of observation, perception, and imagination.

It is known that the main form of thinking is understanding, judgment and mental result. The various combinations of these components of thinking take place in different forms in the secondary school curriculum.

Forms of mathematical thinking – creative, functional and mathematical judgement are closely related to problem solving in teaching mathematics. The forms of thinking put forward by the psychologists and mathematicians-methodologists in the 70s of the last century are closely related to the concepts presented today as new teaching methods.

The fifth paragraph of the first chapter of the dissertation entitled **"Elements of logic as a pedagogical-psychological factor in problem-solving training"** analyzes the pedagogical-psychological facts of the existing issues in the analysis and solution of the problem. There are various problems related with problem solving in teaching mathematics and they might be mentioned in the following way:

1. Problems related to the teacher's knowledge and skills.
2. Problems related to students' cognitive abilities.
3. Philosophical (cognitive) problems related to teacher and student.
4. Problems related to textbooks and methodical aids, etc. Today, the concept of "logical problems" is more common in high school math courses and university entrance exams.

The problems, such as "What is logic", "What issues are considered logical issues and how its elements should be taught" have been examined here. At present, the subject "Logic' is not

taught in the secondary school course. However, there is a need to use logic and its elements in solving many mathematical problems.

In some countries around the world, logic is taught as a separate subject in the secondary school. Logic has not been taught as a separate subject in secondary schools in Azerbaijan since 1955. Mathematical logic, which is considered a "branch" of logic, is taught only indirectly in the process of math training. This does not create all possible opportunities to achieve the stated goal. There is a need to make extensive use of logic elements, especially in solving some problems related to the geometric content line.

According to the statistical report of entrance exams of the State Examination Center,[7] the percentage of correct answers to logical problems is 0.83, and the percentage of incorrect answers is 13.80. However, in recent years, the emphasis on the problems related with logic and thinking in the secondary school textbooks has partially alleviated these problems.

Illustration of a mathematical problem plays an important role in its solution. The opposite of this process, that is, the formulation of a mathematical problem in the description, the determination of the location of functional quantities, is purely logical.

The sixth paragraph, entitled **"Interaction of intradisciplinary and interdisciplinary relations in the learning process"** examines intradisciplinary and interdisciplinary relations in the learning process and related problems. The rapid development of science and technology, the increase in the volume of scientific innovations and knowledge make integrative training relevant. Among the subjects taught in the secondary school, mathematics is the leading subject and plays the role of a real object that reveals the existence of connections between other subjects.

The fact that mathematics is an objective method of real understanding is mainly formed in the process of intradisciplinary and interdisciplinary relations. Intradisciplinary integration involves

[7] Tələbə Qəbulu üzrə Dövlət komissiyası. Qəbul imtahanlarının məzmununun inkişaf dinamikası, Riyaziyyat / – Bakı: – 2012. – 310 s.

the coordination of relevant content lines through internal capacity. According to the structure of the secondary school mathematics course, intradisciplinary integration is carried out in several stages. The implementation of integration between the elements of the same content line by classes arises from the structure of the mathematics course. Two models of integration (horizontal and vertical) are used to consciously master the material being taught. The teacher's pedagogical “skill” and scientific potential for the formation of the connection between the lines of content in the subject form the basis of horizontal integration.

In mathematics training, horizontal integration is linked among five content lines. In traditional mathematics curricula and textbooks, content lines were included in part separately. In this regard, the parallel and mixed inclusion of content lines might be assessed as increasing the effectiveness of training.

The existence of scientific, logical and pedagogical problems in the inclusion of content lines also depends on the structure of interdisciplinary integration. Vertical integration involves the planning of topics (standards) on a quarterly (semi-annual and annual) basis, the development of students' knowledge, skills and habits. Vertical integration must also ensure the realization of interdisciplinary communication.

Students’ memory is strengthened in interdisciplinary communication, students feel the connection between subjects and understand the leading role of mathematics in the study of other subjects. At the same time, with the help of other subjects, they master the content of mathematical concepts. Interdisciplinary relationships not only develop students' mathematical and logical thinking, but also allow them to shape their worldviews. The problems of intradisciplinary and interdisciplinary integration can be identified as follows:

–incorrect inclusion of interdisciplinary integration in the inclusion of topics;

–lack of consideration of students' knowledge and age levels in the study of concepts related to the content line;

–untimely submission of theoretical and practical material on other subjects in the teaching of a particular subject, etc.

The issues of development of intradisciplinary and interdisciplinary communication in the learning process are a complete system and are inseparable components.[8]

The first paragraph entitled "Features of theoretical and methodological issues in problem-solving training" of the second chapter of the dissertation entitled "Methodological issues of problem-solving training in the secondary school mathematics course" examines issues related to this problem.

Here, the features of theoretical and methodological problems, their scientific and methodological classification, the possibility of applying the link between theoretical and practical materials on the content lines have been considered.

Approaches to the problem mentioned in the works of domestic and foreign researchers have been analyzed, the features of the system-structural approach to the concept of the problem have been associated with practice. Issues related to the problem and training cannot be equated. For example, the following problems can be mentioned in connection with the problem statement in traditional mathematics teaching:

–existence of inappropriate standards in the content and method of solving the problem;

–solving standard problems that are broad and repetitive in terms of content in the mathematics course of the secondary school;

–lack of detailed explanation of the role and purpose of the mathematical problem in the learning process;

–lack of purposeful training with problem solving;

–inconsistency of the training method with the problem;

[8] Asadov, M. About the multidisciplinary and interdisciplinary integration in teaching mathematics in Azerbaijani Schools // Azerbaijan State Pedagogical University. Revista Conrado, – Septiembre-Octubre, – 2020. Vol. 16 Núm. 76. https://orcid.org/0000-0002-5511-5193354-362.

–inconsistency of the statement of the problem and its solution with the regularity of development of the student's thinking;

–solution of issues that are not applied and not used in science and technology, practice;

–lack of issues in the training that ensure the development of knowledge, skills and habits of students;

–lack of clear conditions or contradictions between the issues used in the training process;

–incorrect inclusion of intradisciplinary and interdisciplinary communication in the content and solution of the problem;

–excessive time of calculations in the process of solving the problem;

–giving illogical interpretations in the conduct of proof processes, etc.

It is always important to analyze the issues of problem-solving in mathematics training from a methodological, psychological and practical point of view.[9]

These problems still exist in the secondry school mathematics. The third paragraph of the second chapter is entitled “Approaches to the concept of problem solving in the methodological literature and the theoretical basis of modeling the situation”.

This paragraph analyzes the approaches to solving the problem, methods of solution, the implementation of the stages of its solution depending on the type of problem, the selection of algorithms for solving problems on the content lines. The issue is a broad concept and is included in research papers and methodological literature under various names. Thus, along with the concepts of “problem”, “work”, “task”, “mathematical problem”, other phrases, such as “calculate”, “fill in the table”, “prove”, “schedule”, etc. are used. Regardless of the content of the concepts mentioned, theoretical, practical and logical judgments are used to achieve the stated goal.

[9] Колягин, Ю.М. Математические задачи как срдство обучения и развития учащихся средней школы / Автореф. дис. …докт. пед. наук, – Москва, 1977. – 55 с.

Although each of these is a problem in one way or another, there is a different solution algorithm in solving textual problems.

In the secondary school, arithmetic or textual problems usually refer to the relationship between quantities in words. In the tasks given in the form of “calculate with the condition”, “find the value of the expression”, “collect data based on the data”, etc. the solution is performed accordaning to the mathematical operations, the dependences between the quantities. The small number and obviousness of dependencies in solving such problems make the solution easier. In solving textual problems, however, it is usually relatively difficult for students to identify the conditions and dependencies.

The phrase of D.Poya, a prominent methodist–mathematician, *“If a student wants to solve a problem, he must solve problems, just as a fisherman, who wants to learn fishing must first be in the water”*, is still relevant today.

The correct analysis, the correct selection of theoretical and practical knowledge needed to solve the problem is considered to be the main step in solving the problem. The dissertation compares the stages proposed by L.M.Friedman and M.A.Bantova for solving the problem, presents examples of solving practical problems related to common approaches.

When analyzing the numerical values of the quantities given in the context of the problem and the functional dependencies between them, certain models are used to perceive them. In order to visualize the situation in the problem and make the students understand it is one of the most important conditions to choose a model that suits the problem.

In recent years, due to the development of science and technology, a wide range of mathematical methods and their applications have been used in human life. These include mathematical economics, mathematical chemistry, mathematical physics, mathematical linguistics, and so on. Each of them is a certain mathematical model and is used to determine the relationship of relevant objects and events.

In order for the mathematical knowledge acquired by students in the secondary school course to be stable and long-lasting, it is important to conduct modeling on the basis of logic. A brief description of the content of the issue and a proper construction of the situation with the models, such as a picture, diagram, drawing, etc. allow students to develop their future activities.

The creation of any problem, the real state of the situation on the basis of a special logical description, can be considered as mathematical modeling. A mathematical model for the detection of an object and an event, the dependencies between them, is formed as a result of observation. The stages of the model are the transformation of the proposed problem model into a mathematical theory (formation of a mathematical model), the solution model of the problem within the mathematical theory and the translation of the result from the solution of the mathematical problem into the language of the problem.[10]

The model of an object and event can be described in several ways. The dependencies between the components of the model depend on the realization of the state of the object and the event. Modeling is linked to other areas by keeping the elements of content lines relevant. The processes in the modeling of content lines of Geometry, Algebra and functions, Measurements, etc. include mechanics, physics, chemistry, geography, etc. with practical content.

Full-part model, picture, drawing, graphic, diagram are widely used in mastering the content of textual issues. Mathematical modeling plays a key role in the understanding of complex dynamic systems and in the generalization of functional dependencies between its elements. In modeling a geosystem, a natural object is simulated. It is practically impossible to model all the processes of a complex system. However, it is important to note the internal and

[10] Əsədov, M.X. Məsələnin modelləşdirilməsinin nəzəri və metodik əsasları // III Beynəlxalq elm və təhsildə innovativ texnologiyalar simpoziumu, – Bakı 24-25 may 2021. 614bf-be57702aac0348e2ad19e7328f958cb2 www.24kasim.org.

external relationships between its elements in modeling, taking into account the main properties of the object. Quantitative indicators have a special place in the internal and external relations of the system. In the analysis of the studied object, the modeling method is evaluated not only as a quantitative indicator, but also as a quality criterion.[11]

Schematic modeling can be provided by the object itself or by a description that determines its graphical dependence. For example, when describing a situation model in textual issues related to the action, the situation corresponding to the question should be clearly described in the model.

Every calculation based on modeling must be predicated on purely mathematical laws. For example, based on the graph of a quadratic function, noting its properties can be considered a correct judgment. Based on the description, you can write an analytical expression for the function. Thus, the quantities given in the problem and the dependencies between them can be translated into ordinary language and mathematical language with the help of certain symbols.

The third paragraph of the second chapter entitled **"Stages of preparation for the training of algebraic problem solving"** considers the skills that ensure the translation of words and expressions into mathematical language and conversely, the formation of problem-solving equations and inequalities in the preparation for solving textual problems.

Algebraic solution of problems solved in the secondary school mathematics course mainly refers to equations, systems of equations and solutions of inequalities. The basis of this method is still formed in the primary grades and gradually develops in the upper grades. The text of statistical problems and the stages of its solution sometimes result in a geometric description. Dependencies between quantities and the description of the quantity sought within the

[11] Архипов, Ю.Р, Блажко Р.И. Математические методы в географии / Ю.Р.Архипов, Р.И.Блажко. Издательство Казанского Университета, – 1976, – 350 с.

condition must be made in accordance with simple, visual, mathematical terms and symbols. The content of the problems in upper grades should be chosen in such a way that students are interested in constructing an equation to solve such problems. The following may be considered when the condition and the question are presented in a different form:

–the importance of the question sought in finding a solution to the problem;

–ensuring full accuracy in asking the question and compliance with the relationship between the quantities;

–asking a different number of questions according to the context of the issue;

–finding the necessary dependencies and quantities to give an appropriate answer to the condition of the problem;

–compilation of different problems with different content related to the same solution algorithm according to the question, etc.

The main purpose of solving the problem is not only to find the numerical value of the quantity corresponding to the question, but also what knowledge and skills the student will gain in the process of solving the problem. This includes translating the situation into mathematical language based on different schemes. The dissertation describes the stages of preparation for the solution of this type of problem by algebraic methods and the methods of forming dependencies between them in accordance with the content lines.

The fourth paragraph of the second chapter is entitled **"General methods of teaching problem solving by building equations"**. The form of solving the problem with the equation is considered as a special case of modeling. The transformation of the given situation into a simple mathematical language, the determination of the dependences between quantities is based on logical judgments.

Although the model is presented in tabular, schematic, graphical and other forms, abstraction is used in the construction of the equation. It is necessary to try to analyze the methods and models proposed by students in the construction of the model in problem-

based learning by building equations with their participation. The choice of which model to use should be independent. Regardless of the initial stage of the model, the result should fully cover the final situation. This section of the dissertation also analyzes the approaches of researchers in solving problems algebraically.

The fifth paragraph of the second chapter is entitled "**The system of equations and methodological issues of the application of inequalities in the solution of textual problems"**. It is known that in a secondary school math course, some textual problems are solved with the help of a system of equations and inequalities. Experience and researches have shown that in solving textual problems, students prefer a solution based on a certain algorithm, rather than a solution based on mathematical logic and judgment. This solution sometimes yields erroneous results. This paragraph of the dissertation considers the existence of the solution of inequalities, the analysis of possible values that the parameters can take for the solution of the inequalities in which the parameter is included.[12] Interdisciplinary integration is manifested in the solution of practical mathematical problems related to physics and chemistry.

The sixth paragraph of the second chapter is entitled "**Comparative analysis of methods for solving textual problems in the secondary school mathematics"**. The types of problems to be solved in the secondary school mathematics course are defined as follows according to the structure and content of the problem:

1. According to the nature of the object;
2. According to the application of the theory;
3. At the request of the question (seeker).

According to the characteristics of the objects given in the problem, problems can be divided into two types, usually practical (real) and mathematical. By comparing the solution of a problem in different ways, it is possible to determine which approach is more effective in training.

[12] Əsədov, M.X. Mətnli məsələlərin həllində bərabərsizliklərin tətbiqi // Bakı: Azərbaycan Respublikasının Təhsil İnstitutu, Elmi əsərlər, – 2018, №5. – s.111-113.

In any case, the nature of the question is conditionally concluded by calculating, converting, proving or logically substantiating the numerical value of the unknown. In order to solve the problem, the student must clearly understand the content of the problem. Here, the data, the conditions and the unknowns must be clearly identified and analyzed. If the above is possible and the data is sufficient to find the question of the problem, then the situation in the problem should be described in the picture (drawing). Descriptions and analysis can be translated into mathematical language by breaking them down into specific parts (sub-problems).

Arithmetic and algebraic methods are mainly used to solve logical problems in the secondary school mathematics.

Regardless of the method used to resolve the issue, it is important in both cases to meet these conditions in order to understand the content of the issue. When the content of the issue is taken from real life, it is not difficult to describe the objects involved in the issue.

The cases of changing the numerical values of the quantities involved in its content or adding additional conditions to them in comparing the methods of solving the problem have also been considered here. Compiling the inverse problem according to the given problem, assigning a certain numerical value to the quantity sought in the problem and studying the effect of these numerical values on other quantities improve the training process.

Analysis of the solution has always been one of the most pressing issues. To test this process, the teacher can ask students a variety of questions.

These can be as follows:

- is it possible to check the result obtained;
- is it possible to check the stages of problem solving;
- is it possible to get this result in another way:
- is it possible to use the obtained result and solution methods in any other issue?

Motivation (problem situation) can be created at any stage of problem solving. Along with the teacher’s pedagogical and

psychological “skills”, it depends on the students' logical thinking skills, theoretical and practical knowledge levels.

In the new mathematics textbooks, the existing comlications in solving the problems related to the combination of five content lines have been analyzed. Here, during the solution of a complex problem, the rules of its division into several “sub-problems” have been provided and a methodical analysis of the solution of specific problems related to different content lines has been carried out. There are fundamental differences in the content of traditional and new mathematics textbooks. Researchers have always been interested in the effectiveness of mastering and the possibility of applying it in practice. This section examines these problems, analyzes and compares methods of solving textual problems.[13]

The third chapter of the dissertation is entitled **“General complications of problem-based learning in traditional and new mathematics textbooks of the secondary school”**. All paragraphs of this chapter provide a general overview of secondary school math textbooks and related teaching aids.

The first paragraph of the third chapter entitled “Requirements for problem-based learning in traditional and new Mathematics-5 textbooks and its status” examines the modern requirements for problem solving in the textbooks from a scientific and methodological point of view. The effectiveness of the methods proposed in solving the problem in the textbook Mathematics-5, written on the basis of the curriculum has been compared with the traditional textbook. The ways have been shown to overcome some of the shortcomings in the textbook. For example, the differences between the concepts of “equality of figures” and “congruent figures” and the form in which they are included in the textbook have been scientifically and methodologically substantiated.

[13] Əsədov, M.X. Məsələ həllində fiqurların oxşarlığının tətbiqi // – Bakı: Pedaqoji Universitetin xəbərləri, Riyaziyyat və təbiət elmləri seriyası, – 2018. №1, – s.29-35.

The second paragraph of the third chapter is entitled “Practical applications of teaching problems in the textbook Mathematics-6”. Here the structure and content of the issues given in the textbooks have been analyzed, positive and negative aspects in their compilation and solution have been noted in the methodical guidelines. In connection with the solution of the problem, the existing problems have been analyzed in the methodical manual for Mathematics-6 teacher.

From our analysis of the Mathematics-6 textbook written on the basis of the curriculum, we conclude that there are certain complications in the textbook related with problem-solving. Scientific and methodical proposals have been provided in the dissertation to eliminate these shortcomings.

In the third paragraph of this chapter, entitled **“Didactic functions of the teaching problem in the textbooks Algebra-7 and Mathematics-7”**, the didactic functions of the problem have been studied on the relevant content lines. The structure of the traditional Geometry-7 textbook, the role and importance of problem solving in the inclusion of geometric concepts have been noted. It is noted that in the new textbook of Mathematics-7, when introducing geometric content lines, intradisciplinary relations are preferred. In both textbooks, the didactic functions of the problem have been analyzed in general.

The fourth paragraph of the third chapter “The connection of content lines in traditional and new Mathematics-8” textbooks. Here, along with the analysis of the structure of textbooks, the relationship of content lines has been studied on specific issues. Possibilities of using other content lines in solving problems related to geometric content line have been methodologically analyzed. The selection of the analyses in accordance with the age and knowledge skills of students, the application of the acquired theoretical knowledge to practice have been explained in detail in the dissertation.

The fourth paragraph of the third chapter is entitled “Comparative analysis of the textbooks Algebra-9, Geometry-9 and Mathematics-9 in terms of problems and modern requirements”.

Theoretical problems in textbooks and methodical aids have been connected with the solution of practical problems. It was noted that the mathematics course is integrative and its main features are more widely reflected in the ninth grade.

The construction and analysis of the graph of the function, the possibility of using functional dependence in solving problems of similarity have been examined in combination in the solution of specific problems. Some concepts given in the textbook Mathematics-9 have been presented as an innovation in the methodical manual. It has been substantiated by facts that some of these concepts existed in the Soviet education system in the 60-70s of the last century.

The first paragraph of the fourth chapter entitled **"Applications of interdisciplinary integration in problem-solving training in the secondary school mathematics course"** is dedicated to the **"Issues of percentage-related problem-solving training in the secondary school"**. It is known that in the secondary school course, starting from the fifth grade, all types of percentage-related issues are solved in all upper grades. A certain algorithm is used to solve simple percentage problems and students do not have difficulty in solving this type of tasks. In the dissertation work, theoretical and methodological problems in solving percentage-related problems have been revealed and their reasons have been explained from a methodological point of view.

Experience shows that students have some difficulty in solving a problem when they are not given numerical values. There are some complex issues in which not two, but three or more quantities can be involved. The identification of dependencies between these quantities is based on logic. Problems sometimes arise in solving such practical problems, the content of which is taken from real life. Curriculum-based textbooks cover percentage-related problems related to economics, business, biology, and medicine. The dissertation examines the problems that arise in solving such problems theoretically and methodically. Different methods of

solving some complex problems based on the “complex trinity rule have been analyzed.

The second paragraph of the fourth chapter is entitled **“Methods of teaching problems related with motion”**. General methodological information have been provided here about the quantities that characterize the movement and the stages of including these quantities in the secondary school mathematics course. The dissertation notes that the situations presented in complex issues related to the movement are mainly modeled and visualized. Building a model according to the content of the problem or textual representation of the data in the problem on the basis of the model (drawing, scheme) allows students to form spatial ideas. In the study of the concepts mentioned here the preference should be given to interdisciplinary communication.

After the theoretical knowledge of the motion of a body in physics has been repeated by students, it is possible to look at the solution of some complex problems by abstraction. There are problems in mathematics related to motion that can also be applied to physics. Therefore, it is relative that some problems related to motion are related to mathematics or physics.

The second section of the second paragraph is entitled **“The state of dependence of quantities on problems related with the motion in the same direction”**. Depending on the conditions of the problem, the complications that arise when solving the problem of increasing the number of objects involved in the motion have been considered. This section addresses the issues in the secondary school course with increasing difficulty related to the motion. The following types of issues related to the same direction have been considered here:

1. Issues related to the movement of objects with different speed from one point at the same time and in the same direction;
2. Issues related to the movement from one point at different times and in the same direction;
3. Issues related to the movement from two points at the same time and in the same direction;

4. Issues related to the movement from two points at different times and in the same direction.

The dissertation analyzes the ways of overcoming the difficulties encountered by students in solving such practical problems and provides certain methodological instructions.

The third section of the second paragraph, entitled **"Generalization of the dependence of quantities on issues related to reverse motion"**, is dedicated to the study of reverse motion of objects. The dependencies between the quantities have been generalized here, according to the direction of motion, and the following types of problems related to reverse motion have been considered:

1. Movement from the same point in the opposite direction at the same time.

If the velocities of these objects are V_1 and V_2, respectively, then after a certain time t the distance between them will be $S1 = t \cdot (V1 + V2)$.

2. Two objects can move in opposite directions from different points. Initially, if the distance between these objects is S, then the distance between them at the same time t is $S_1 = S + t \cdot (V_1 + V_2)$. Here V1 and V2 are the velocities of moving objects, respectively.

These theoretical materials are obtained as a result of solving practical problems.

The fourth section of this paragraph, entitled **"Methodology of teaching problems related to the motion around the circle"** summarizes the methodology of teaching the types of problems related to movement.

It is noted that in the course of mathematics and physics, some features of objects are abstracted when solving problems related to the circular movement. In contrast to linear motion, in circular motion, there are some concepts that, when used in solving a problem, illustrate the relationship between mathematics and physics.

In the dissertation, concepts such as rotation time (period), rotational frequency, change of direction (acceleration, centrifugal

acceleration, etc.) in a circular motion have been analyzed mathematically and physically.

A comparative analysis between the solutions of problems related to circular movement from the same point in the opposite direction and linear uniform motion has been carried out. Interdisciplinary relations have been considered in the solution of issues related to finding the time of the meeting of the cars moving in the opposite direction from the same point of the circular road of a certain length.

The solution of this type of problem can be compared to the opposite problems in a linear uniform motion. However, the comparison in this way may be within a certain range. This is because the distance between objects decreases in a certain time interval during the movement in the opposite direction. After the meeting, the distance between them gradually increases for some time. Since the motion in a circle is periodic, the motion here can be compared to a linear uniform motion over a period of time.

The fifth section of the second paragraph, entitled “Methods of teaching problems related to the movement in running water” examines the methodology for solving problems related to the movement of objects in running water (river). Here, the issues of the velocities of the object and the flow, the change of the final velocity depending on the type of movementhave been explained from a theoretical and methodological point of view.

The third paragraph of the fourth chapter is entitled “Methods of teaching applied problems related to the movement”. There are such problems related with the motion in the secondary school math that are widely used in geometric content line elements. In the dissertation the analysis of cases of change of distances between the objects moving in the mutually perpendicular direction from the same point has been carried out.

The fourth paragraph of the fourth chapter entitled “Methods of teaching the solution of problems related to the mixture”, examines the general state of the problems related to the mixture in the school mathematics course. In the preparation of food, clothing, building,

etc. certain mixtures are used. The theoretical and methodological bases of the use of mathematical calculations in estimating the value of the obtained mixture have been explained here. The solution of some problems given in mathematics textbooks and using interdisciplinary communication in their solution has been considered.

In the secondary school math, there are problems that can be solved in the same way, even if their content is different. Mixed-language math textbooks in traditional and curriculum-based secondary schools allow students to develop their knowledge, skills, and habits. At the same time, more time is allocated to interdisciplinary communication in solving such problems. In particular, the use of mathematical apparatus (theory) in the teaching of physics and chemistry in the upper grades, the solution of such problems in different ways forms the concept of a single subject combination (unity) in students. Research and analysis show that some of the problems related to the mixture in the secondary school mathematics are solved in both physics and chemistry. Let's consider the problem on page 142 of the traditional Mathematics-6 textbook.[14]

"The weight of the alloy of gold and silver is 13 kg 410 g. When completely immersed in water, it weighed 12 kg 510 g. Determine the amount of gold and silver in the alloy, knowing that the densities of gold and silver are 19.3 g / cm3 and 10.5 g / cm3, respectively".

The content of this issue is related to physics. The solution to this problem can be achieved through interdisciplinary integration. However, while including these issues in the textbook the integration of subject programs should be taken into account. It is not methodologically correct to present in a mathematics course issues related to subjects that are not taught in parallel in physics and chemistry. There are some concepts that are difficult to inform

[14] Mərdanov, M.C və başqaları. Riyaziyyat-6, Ümumtəhsil məktəblərinin 6-cı sinfi üçün dərslik / Bakı: Çaşıoğlu, – 2007. – 336 s.

students because they are not taught in parallel in other subjects. According to Archimedes' law, the mass lost when immersing an alloy in water is equal to the mass of water it displaces. The amount (capacity) of water squeezed out is equal to the volume of the alloy immersed in water. These are purely physical concepts, and students will not be able to solve them without knowing these concepts from physics. So, in order for students to understand the content of the problem, they need to know the concepts known from chemistry, physics - solution, alloy, their viscosity ratio, etc.

In the first section of this paragraph entitled “Application of knowledge of chemistry in solving problems related to the mixture of liquids”, ways to use knowledge of chemistry in solving mathematical problems, the content of a method called “Parsine envelope” based on mathematical calculations in solving problems related to the mixture of liquids have been explained. In order to avoid mistakes when using the Parsin method, the following steps can be brought to the students’ attention:

–indicate the numerical value of the one with the highest percentage of concentration in the solution above the left side of the rectangle and the one below the lowest;

–record the percentage of viscosity of the obtained mixture at the point of intersection of the diagonals of the rectangle;

–mark the difference of the quantities along the diagonal at the point of intersection of the diagonals of the rectangle;

–the difference in the diagonal length of the quantities is marked on the right side of the rectangle, respectively.

Methods of solving practical problems without performing complex mathematical calculations with the help of this method has been considered.

The second section of the fourth paragraph entitled **“Application of knowledge of physics in solving problems related to alloys”**, comprehensively examines the relationship between mathematics and physics in solving problems related to the mixture (alloy) of metals. In some cases, the properties of quantities are abstracted in the solution of mathematical problems in physics.

However, there are problems with mathematical content that are solved using knowledge of physics.

Taking into account the cases mentioned in this paragraph of the dissertation, the solution of specific issues has been analyzed from a theoretical and methodological point of view. Some solution methods used in the mixture of liquids have been referred here and the features of interdisciplinary integration have been taken into account during the solution.

The last paragraph of the fourth chapter is entitled **"Pedagogical experiment and its results"**. In order to test the effectiveness of the research hypothesis and the developed methodology, the experiment was carried out in the following stages:

Phase I - 2013-2014

Phase II - 2015-2016

Phase III - 2017-2018.

The pedagogical experiment was carried out in schools number 36, 42, 45, 82, 200, 280, 281 of Baku. The following tasks were set during the experiment in connection with the theoretical, practical and methodological problems of problem-solving training in the secondary school mathematics course:

1. Identification of the problem and determine the cause in the problem-solving training related to the content lines.
2. Analysis of the state of intradisciplinary and interdisciplinary integration in the inclusion of content lines by grades.
3. Selection of existing problems in problem solving training. Along with the problems associated with the activities of the teacher and learners, shortcomings in the textbook are also included.
4. Identification of the difficulties faced by students in the study of theoretical materials and their application in practice.
5. Creating an opportunity for applying the methods used in solving simple problems in the solution of more complex problems by analogy.

6. Complex use of observation, comparison, generalization, analysis, synthesis and other training methods in problem solving and generalization of the obtained result.

7. Determining the level of students' development, along with determining the level of judgment, intuition and logical abilities.

Phase I is the first stage of the experiment, called the determinant. This stage considers the identification of theoretical, practical and methodological complications of problem-solving training in the secondary school course, the determination of the level of students' preparation on content lines, the determination of the theoretical and methodological bases for problem solving, general conversation with students, the state of test writing, diagnostic analysis of writing and speaking skills, analysis of initial data obtained during meetings with the class supervisor and subject teacher, selection of experimental and control classes, giving preference to classes taught by the same teachers in parallel classes, providing general information to subject teachers about the content of the proposed methodical system;

Phase II is called the teaching phase of the pedagogical experiment and work has been done to teach and apply the proposed methodological system in the school course. At this stage, individual conversations were held with mathematics teachers of the experimental classes and the results of the preparatory work for the implementation of this stage were analyzed. Here, the content of the methodological system proposed by the author, the theoretical and methodological proposals presented to reduce the complications related to problem solving were brought to the attention of subject teachers.

In the various variants organized by classes, test writing works include open-ended questions as well as test-type works. Some of the problems in existing traditional and curriculum-based textbooks have also been used in the compilation of these tasks.

The conditions of intradisciplinary and interdisciplinary integration have been taken into account in the proposed problems in

accordance with the theoretical and practical complications mentioned for the experimental classes.

Phase III is called the testing phase of the pedagogical experiment and it examines the level of realization of the stated goal. Here, the theoretical and practical complications of problem solving in the school course are identified, the effectiveness of the presented methodological system is analyzed. After studying the program materials of the classes involved in the experiment, re-examination materials were identified and in accordance with the program, control tests were organized in both control and experimental classes.

After the analysis of the results, certain necessary corrections were made in the content of the problems and the approach to the methodological system. In addition to the problems based on certain algorithms, judgments and logic were also included in the test papers.

At the end of the pedagogical experiment, all corrections and additions were taken into account. The statistical method given in the methodical literature was used to analyze and compare the results of the pedagogical experiment.

Relevant tables have been provided to analyze and compare the results of the experiment.

The meaning of the parameters given in the table is as follows:

1. n – number of students
2. W_a – fashion (most recurring price)
3. d – the difference between neighboring prices
4. $\sum$ – is the number of values before the median
5. f – is the frequency of the class in which the media is located, or the number of values.
6. M_e – median: $M_e = W_a + \frac{d \cdot (\frac{n}{2} - \sum)}{f}$
7. σ – the sum of all prices.
8. G – numerical average value.
9. M_e – is a quantity that indicates the tendency of the result to change.

The results of the experiment conducted for one school based on the above statement are given in the following tables. In the dissertation, the general results of the experiment are interpreted for the relevant V-IX grades of the above-mentioned schools.

Stage I

Experimental classes

Table 1.

Number of students	Values				W_a	$\sum$	f	M_e	σ	G	M_e-G
	2	3	4	5							
28	3	15	8	2	3	3	15	3.73	93	3.32	0.41
27	2	15	8	2	3	2	15	3.76	91	3.37	0.39
24	1	14	6	3	3	1	14	3.78	83	3.45	0.35
30	5	12	9	4	3	5	12	3.83	102	3.40	0.43
24	2	12	8	2	3	2	12	3.83	82	3.41	0.42

Stage I

Control classes

Table 2.

Number of students	Values				W_a	$\sum$	f	M_e	σ	G	M_e-G
	2	3	4	5							
18	3	8	6	1	3	3	8	3.75	59	3.27	0.48
22	4	12	5	1	3	4	12	3.58	69	3.13	0.45
24	3	14	5	2	3	3	14	3.64	78	3.25	0.39
17	3	8	4	2	3	3	8	3.68	56	3.29	0.39
20	4	6	8	2	4	6	8	4.75	68	3.40	0.35

Stage II
Experimental classes

Table 3.

Şagirdlərin sayı	Values				W_a	∑	*f*	M_e	σ	G	M_e-G
	2	3	4	5							
27	1	9	14	3	4	9	14	4.35	100	3.70	0.65
27	1	10	12	4	4	10	12	4.29	100	3.70	0.59
24	0	12	8	4	3	0	12	4.00	88	3.66	0.34
30	2	9	14	5	4	9	14	4.42	112	3.73	0.69
24	0	11	9	4	3	0	11	4.09	89	3.70	0.39

Stage II
Control classes

Table 4.

Number of students	Qiymətlər				W_a	∑	*f*	M_e	σ	G	M_e-G
	2	3	4	5							
18	2	9	7	0	3	2	9	3.77	59	3.27	0.60
21	3	13	4	1	3	3	13	3.57	66	3.14	0.43
23	3	12	6	2	3	3	12	3.70	76	3.30	0.40
18	2	10	5	1	3	2	10	3.70	59	3.27	0.43
20	3	7	8	2	4	7	8	4.37	69	3.45	0.92

An analysis of the results of the experiment shows that while the success rate in the control classes ranged from 70% to 82%, the

quality percentage from 34% to 46%, the success rate in the experimental classes ranged from 82% to 93% and the quality percentage from 48% to 64%. This proves the superiority of the combined approach in problem-solving training and the validity of the hypothesis put forward in the study. After the analysis of the experiment, the following results can be noted:

1. Insufficient knowledge of students' perception and comprehension when analyzing the content and solution of textual problems. The root of these problems can be explained by the poor organization of students' problem-solving skills in primary school.

2. Improper execution of the process of fractionation and transformation of numbers with different names in the process of solving the problem. At the same time, there are problems with functional dependencies between quantities.

3. Students have difficulty in applying theoretical knowledge in practice – in exercises and solving textual problems. The reasons for this are:

- the small number of practical exercises in the textbook related with real life;
- incorrect application of pedagogical and psychological approaches in textbooks written on the basis of the curriculum;

4. Sometimes the amount of didactic tasks offered for the study of theoretical and practical material in the textbook is too large. At this stage, students' age and knowledge should be taken into account. The scale of the initial steps taken into account for reading a huge problem, understanding the given and sought quantities and for solving it. These problems are clearly noticed in the textbook.

5. Analysis of the situation in the problem, its visualization, modeling of the relevant situation increases the interest of students in solving the problem. These processes enable the problem-solving.

6. incorrect entry of names of mathematical concepts in including probable and mathematical statistics elements. These cases exist in the inclusion of the concept of probability in the mathematics textbooks of grades IV, V, VI and there are repetitions in terms of content. As a result of the experiment, it is noted that the increase of

students' knowledge and skills in the school course, the development of their mathematical and logical thinking is closely linked with problem solving.

General results and recommendations of the research.

The improvement of the quality of mathematics education in secondary schools is one of the most pressing issues and is directly related to problem solving. In the presented dissertation, the theoretical and methodological issues of problem-solving training in the secondary school mathematics course have been comprehensively studied for grades V-IX and the following results were obtained:

1. By examining the scientific and methodological literature related to the problem and analyzing the objects that make up the training in the secondary school course, we can note that problem-solving training is an invaluable tool. The formation of students' worldviews and their development as individuals is in one way or another related to mathematical education.

2. For the rapid development of science and technology, the increasing source and volume of information, the correct transmission of scientific innovations to the next generation, the use of traditional approaches in training alone can not be considered acceptable.

3. Theoretical, practical and methodological problems of problem-solving training in the secondary school mathematics course can be generally described as follows:

−problems related to the stages of training. This is mainly due to the fact that intradisciplinary integration and programs do not include inheritance correctly;

−scientific and pedagogical problems related to the teacher's activity;

−problems related to students' activities. Insufficient knowledge and skills of students or various reasons that prevent the creation of motivation in the learning process, including psychological factors;

–theoretical and methodological problems related to the textbook. The main form of organization of training is a lesson, and one of the main objects of its realization is a textbook. There is no ideal textbook concept. There are serious scientific and methodological shortcomings in the mathematics textbooks currently used in secondary schools and written on the basis of the curriculum. These problems are included in the content of the dissertation and analyzed specifically for different classes.

4. Practical knowledge gained in the process of solving textual problems is summarized and included as theoretical material. Presentation of theoretical material in this way strengthens the developmental and creative activity of students.

5. Taking the content of the problem from real life, selecting students according to their age and level of knowledge, along with increasing their creative activity, develops their mathematical and logical thinking.

6. The structure of the theoretical materials given in the textbooks, the presentation the concepts with different content under the same name can be considered as the existing complications of problem-solving training. The cases mentioned in the new mathematics textbooks of grades V and VI have been conspicuously reflected.

7. There are certain problems in the provision of textbooks in the secondary school mathematics course under the name of a single textbook – “Mathematics” and its coverage of five content lines. The principle of “balance” was not followed in the inclusion of the content lines mentioned in the mathematics textbooks for the classes. This includes, in particular, mathematics textbooks based on the curriculum for grades V-VII. The principle of consistency must be followed in coordinating and incorporating content lines.

8. Too little allocation for theoretical materials in textbooks and the predominance of mastering theoretical materials mainly through problem solving cause the following problems:

–the lack of a minimum theoretical material on each topic stops the level of mastery and development of weak students in the classroom;

–it is pedagogically and psychologically impossible to teach theoretical material to the whole class through voluminous problems;

–incomplete integration of theory and practice in textbooks should be considered as a factor that negatively affects the acquisition of students with different knowledge and skills.

9. Some of the approaches presented to the pedagogical community today as new teaching methods existed during the Soviet era and the pros and cons of their use have been analyzed. For example:

The methodical manual “Methods of teaching mathematics in secondary schools”, authored by V.Bradis and published in 1954, deals with the use of geometric illustrations (square, rectangular, etc. models) in multiplication of monomial by polynomial, multiplication of a polynomial by polynomial, quadratic equations: Sum and difference of two expressions, etc. Having considered the difficulty of the proposed methods (approaches) for students, the approach mentioned in the textbooks at that time was abandoned. This approach was associated with the name of professor I.Y.Depman. However, today these issues have been considered again in the textbook “Mathematics-7” written on the basis of the curriculum. This contradicts the requirements of the curriculum.

10. The indirect rather than explicit dependence of quantities in the content of textual problems creates difficulties for students in the process of problem analysis. In order to solve these complications, it is important to compile and solve the inverse problems. Solving different types of simple problems (by groups) allows solving relatively complex problems.

11. When the numerical values of the dependencies between quantities are given depending on the parameter, students face difficulties in solving such problems. Observations during the research show that students make certain mistakes when solving parametric textual problems.

12. When solving textual problems through inequalities and a system of inequalities, students are not able to clearly identify the relationships between quantities, or the results are inconsistent. In this way, it is advisable to consider the solution of non-textual problems before solving textual problems. It is possible to suggest problems related to the motion in accordance with the above cases.

13. One of the factors that toughen the quality of modern education is the choice of directions of developmental training in accordance with the students' age and level of knowledge. The place and role of developmental learning in mathematics education is obviously noticed. The teacher plays a leading role in coordinating the didactic and methodological bases of this. In this regard, the teacher should pay attention to the content of the problems presented to students and the relationship to the content lines.

14. Logical problems in geometry, especially in construction and proof, are sometimes related to intuition. Since intuition is a product of creative thinking, in solving problems based on purely theoretical material, preparations must be made for the solution of such problems. Adherence to the principle of "inheritance" in problem-solving training leads to the development of students' judgment and creative abilities.

15. The methods used to solve the problem and the approaches to their combination have been distorted in the methodological manuals for teachers. The general approaches included in the problem-solving methods are presented as separate training methods. Solving the problem is a different concept from its methodological approach. The solution of any problem in the teacher's manual cannot be considered as a methodical approach. This can lead to certain problems in the activities of young teachers.

16. There are some problems with the inclusion of elements of the "Statistics and probability" content line in new secondary school mathematics textbooks. These problems have not been covered extensively in traditional mathematics textbooks. There are methodological problems along with the scientific problems of including any topic in the textbook. The problem of adding these

topics from high school curricula to the secondary school textbooks is inevitable.

The lack of methodological research on the “Statistics and probability” content line, which is included as a new section in secondary school mathematics, raises existing problems. It should also be noted that the theoretical material related to this section was included in the textbooks without any experiment. The inclusion of theoretical material in the secondary school math course without any experiment and research can be considered an egregious mistake.

17. One of the theoretical and methodological issues of problem-solving training in the secondary school mathematics course is the incorrect integration of the “Mathematics” curriculum with the programs of other subjects. The possibilities of interdisciplinary integration should be taken into account in the inclusion of mathematical problems related to subjects physics, chemistry, geography, etc. in textbooks. There are some problems that need to be addressed in order to take into account the theoretical knowledge of students in physics and chemistry in accordance with the program.

18. In the new textbooks and teaching aids for teachers, special attention has been paid to logical problems and methods of their solution have been indicated. The subject “Logic” is not taught in the secondary school course. In addition to being an ancient science, logic is widely known about its forms and history of development. However, it should be borne in mind that the assignment of such problems to students with little theoretical and practical knowledge of basic mathematical concepts is contradictory. Thus, it is not pedagogically and psychologically correct to give more complex and non-standard problems to students who do not fully master simple mathematical concepts.

It is true that some logical questions based on judgment in textbooks are given in accordance with the program and the age of students. If this “balance” is not kept in the learning process for some reason, it can lead to a decrease in students' interest in learning mathematics.

19. Analysis of the results of the pedagogical experiment shows that the proposed methodological system improves the quality of mathematics education and allows students to develop mathematical skills.

20. As a result of our pedagogical experiment, the percentage of knowledge acquisition in the classroom increased by about 7-8%, and the quality indicator increased by 9-11%. This not only confirms the effectiveness of the proposed methodological system, but also makes it necessary to widely apply it in secondary school mathematics courses.

The following **recommendations** can be made regarding the research:

1. To ensure the elimination of scientific and methodological shortcomings in the textbooks analyzed in the dissertation by grades and the implementation of certain improvements.

2. The use of too many different colors in textbooks not only distracts students, but also hinders the development of intuition. To ensure the simplicity the textbook in terms of language and the correct use of accepted mathematical symbols and concepts in the naming of mathematical concepts.

3. To analyze the statistics of mastering of new concepts introduced in mathematics textbooks and to ensure the involvement of mathematician scientists, pedagogues and psychologists in the writing of mathematics textbooks.

4. It is necessary to pay more attention to the solution of non-standard problems in order to develop students' creative judgment, mathematical and logical thinking, while sticking to the principle of “from simple to complex, from easy to difficult”.

5. To increase the number of practical problems pertaining to the comparison, analogy and generalization among the elements of “Geometry” content line and to analyze the scientific and methodological shortcomings related to this content line. Existing scientific concepts such as reflection, rotation, symmetry, equality and congruence have been distorted and no age-appropriate

interpretations have been provided. To ensure the elimination of these shortcomings.

6. Considering the dearth of methodological aids for studying the problems related to the content line “Statistics and Probability”, it is necessary to develop methodological aids and recommendations with the participation of experts in this field. At the same time, it is necessary to analyze the possibilities and consequences of the inclusion of some topics (previously taught in the University) in the secondary school mathematics course. I think that some topics should be removed from the secondary school textbooks. These include the calculation of the probabilities of dependent and independent events through the theory of combinations and other topics.

7. In the process of solving problems related to proof and construction, to ensure the priority of proposals based on logical judgment.

8. To take into account the combined approach to ensure interdisciplinary integration in the programs and textbooks of mathematics, physics, chemistry.

The problem is an indispensable tool in increasing motivation and in the development of students' mathematics, logical thinking and for its realization it is important to properly organize interdisciplinary integration. Observations and pedagogical experiment proved it.

9. To ensure the introduction of the subject “Logic” in the upper grades of the secondary school and the organization of special courses for teachers involved in its teaching.

The main content of the dissertation is reflected in the following scientific works of the author:

1. Əsədov M.X. Məsələnin müxtəlif üsullarla həllinin müəllim hazırlığında rolu/ «Xəbərlər» Təbiət elmləri seriyası. Bakı: ADPU-2006, №2, səh.17-21.

2. Əsədov M.X. Triqonometrik funksiyaların dövrünün tapılması haqqında / Müəllim hazırlama Siyasəti və Problemləri Beynəlxalq Konfrans, Bakı: ADPU- 2007, I hissə səh.785-788.

3. Əsədov M.X. Triqonometrik tənliklərin həllində çoxluqların birləşməsi əməlinin tətbiqi metodikasına dair/ Pedaqoji Universitet xəbərləri. Pedaqoji psixoloji elmlər seriyası, Bakı: ADPU- 2007, №6 səh. 320-323.

4. Əsədov M.X. İbtidai təhsilin pedaqogikası və metodikası fakültəsinin riyaziyyat kursunda «birləşmələr nəzəriyyəsinin elementləri» mövzusunun tədrisi metodikasına dair/ Pedaqoji Universitet xəbərləri. Pedaqoji psixoloji elmlər seriyası, Bakı: ADPU-2009, №1 səh. 282-285.

5. Əsədov M.X. Ədəd anlayışı və onun inkişaf mərhələləri Pedaqoji fakültənin 50 illik yubileyinə həsr olunmuş elmi-praktik konfransın materialları/ Bakı: ADPU-2010, səh.278-283.

6. Əsədov M.X. Riyaziyyar (dərs vəsaiti)//, Bakı: ADPU, 2010, 212 s.

7. Əsədov M.X. Riyazi təfəkkürün inkişafında məsələ həllinin rolu/ Fizika, Riyaziyyat və İnformatika tədrisi, Elmi-nəzəri və metodiki məcmuə. Bakı: AMİ- 2011, №3 səh. 31-36.

8. Əsədov M.X. İbtidai siniflərdə riyaziyyat təlimi prosesində funksional asılılıq ideyasının inkişafı mərhələləri/ Pedaqoji fakultənin professor-müəllim heyətinin ADPU-nun 90 illiyinə həsr olunmuş elmi-praktik konfransının materialları. Elm və təhsil, Bakı: ADPU-2011 səh. 103-107.

9. Əsədov M.X. Riyazi təkliflər və anlayışlar (dərs vəsaiti)// Bakı: ADPU-2012. 164 səh.

10. Əsədov M.X. Məsələ həllində qrafdan istifadə / Pedaqoji Universitet xəbərləri. Pedaqoji psixoloji elmlər seriyası. Bakı: ADPU-2014, №2 səh. 455-459.

11. Əsədov M.X. Məsələ həllində müasir və ənənəvi təlim metodlarının tətbiqi/ "Müəllim hazırlığının müasir problemləri: texnologiya, təhsil və inkişaf" III Elmi Konfransın materialları, Bakı: 22-24 may 2014 səh. 183-184.

12. Əsədov M.X. Orta məktəbin riyaziyyat dərsliklərində faiz anlyışının tədrisinə dair/ Azərbaycan Respublikası Təhsil Problemləri İnstitutu, Elmi əsərlər, Bakı:- 2014, №3 səh. 88-91.

13. Əsədov M.X. Riyaziyyat tədrisində fiziki anlayışlardan istifadə/ Pedaqoji Universitet xəbərləri. Pedaqoji psixoloji elmlər seriyası. Bakı: ADPU-2014, №2 səh. 439-442.

14. Əsədov M.X. Orta məktəbin riyaziyyat dərsliklərinin problemləri/ Azərbaycan Respublikası Təhsil Nazirliyi. Doktorantlarınvə gənc tədqiqatçıların XIX Respublika Elmi Konfransının materialları. Bakı-2015, II cild səh.253-255.

15. Əsədov M.X. Riyaziyyat təlimində inteqrasiya/ Azərbaycan xalqının ümummilli Lideri Heydər Əliyevin anadan olmasının 92 illiyinə həsr olunmuş Müəllim hazırlama siyasəti və problemləri V Beynəlxalq Konfrans materialları Bakı,30 aprel 2015-02 may 2015 səh. 237-240.

16. Əsədov M.X Riyaziyyat təlimində modelləşdirmənin mərhələləri/ Azərbaycan Respublikası Təhsil Nazirliyi. Doktorantlarınvə gənc tədqiqatçıların XX Respublika Elmi Konfransının materialları. Bakı-2016, I cild səh.15-17.

17. Əsədov M.X. Məsələ həllində nəzəri praktik materialların rolu/ Pedaqoji Universitet xəbərləri. Pedaqoji psixoloji elmlər seriyası. Bakı: ADPU-2017, №4 səh. 30-35.

18. Əsədov M.X. Faiz hesablamalarına aid məsələlərin həlli üsulları/ Azərbaycan Respublikası Təhsil Nazirliyi. Bakı Qızlar Univrrsiteti, Elmi əsərlər, Bakı-2017, №4 səh.182-187.

19. Əsədov M.X. Tənliklə məsələ həllinə dair/ Azərbaycan Respublikası Təhsil Nazirliyi. Bakı Qızlar Univrrsiteti, Elmi əsərlər, Bakı-2018, №2 səh. 185-189.

20. Əsədov M.X. Məsələ həllində təfəkkür əməliyyatları mühüm vasitə kimi/ Azərbaycan Respublikasının Təhsil İnstitutu, Elmi əsərlər, Bakı-2018, cild85, №5 səh.67-70.

21. Əsədov M.X. Mətnli məsələlərin həllində bərabərsizliklərin tətbiqi/ Azərbaycan Respublikasının Təhsil İnstitutu, Elmi əsərlər, Bakı-2018, №5 səh.111-113.

22. Əsədov M.X. Məsələ həllində fiqurların oxşarlığının tətbiqi/ Pedaqoji Universitetin xəbərləri, Riyaziyyat və təbiət elmləri seriyası, Bakı: ADPU-2018, C. 66, №1 səh.29-35.

23. Əsədov M.X. Riyaziyyatın ibtidai kursunun nəzəri əsasları (dərs vəsaiti)// Bakı: ADPU-2018, 240 səh.

24. Əsədov M.X. Orta məktəbin riyaziyyat kursunda məsələl həlli təliminin nəzəri metodik problemləri.(V-IX siniflər üçün)// Monoqrafiya, Bakı: "Elm və təhsil"- 2018, 384 səh.

25. Əsədov M.X. Məsələnin modelləşdirilməsinin nəzəri və metodik əsasları. III Beynəlxalq elm və təhsildə innovativ texnologiyalar simpoziumu, Bakı 24-25 may 2021, 614bf-be57702aac 0348e2ad19e7328f958cb2 www.24kasim.org

26. Асадов М.Х. Об активизация познавательной деятельности учащихся по математики в V-VI классах/ Высшая школа Казахстана. Международное научно-педагогическое издание, Алматы-2011, №3 ст.109-113.

27. Асадов М.Х. Əsədov M.X. Методические вопросы обучения решению задач в школе "Фундаментальные и прикладные исследования в современном мире/ Материалы V Международной научно-практической конференции (12-13 марта 2014 г) Санкт- Петербург 2014 ст.114-118.

28. Асадов М.Х. Обучение методам решения математических задач/ Казахский национальный педагогический университет имена Абая. Серия «Педагогических науки» Алматы, №2(46), 2015 ст.297-299.

29. Асадов М.Х. Межпредметные интеграции в обучении математике Miçdzynarodowe czasopismo naukowe ,Warzawa Polska-2018, №3(14), ст. 32-34.

30. Asadov Mubariz Khasay Oglu About the multidisciplinary and interdisciplinary integration in teaching mathematics in Azerbaijani Schools/ Azerbaijan State Pedagogical University. Revista Conrado, VOL. 16 NÚM. 76 (2020):Septiembre-Octubre) / https://orcid.org/0000-0002-5511-5193354-362

31. Asadov Mubariz Khasay Oglu Ways to use the model in solvingtext problems/. p.236-241 https://sci-conf.com.ua/iv-mezhdunarodnaya-nauchno-prakticheskaya-konferentsiya-eurasian-scientific-discussions-8-10-maya-2022-goda-barselona-ispaniya-arhiv/

The defense will be held on November 29, 2022 at 14:00 at the meeting of the One-time Dissertation council BED 2.15/1 of Supreme Attestation Commission under the President of the Republic of Azerbaijan operating at Azerbaijan State Pedagogical University

Address: Az.1000, Baku, Uzeyir Hajibeyli street, 68, Azerbaijan State Pedagogical University, main building, small hall.

Dissertation is accessible at the Azerbaijan State Pedagogical University Library

Electronic versions of dissertation and its abstract are available on the official website of Azerbaijan State Pedagogical University.

Abstract was sent to the required addresses on October 26, 2022.

Signed for print: ___.09.2022

Paper format: 60x84 1/16

Volume: 89453

Number of hard copies: 30