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ABSTRACT

Of the dissertation for the degree of Doctor of Philosophy

SYSTEM OF WORK ON MATHEMATICS TEACHER TRAINING IN THE INFORMATION SOCIETY

Speciality: 5801.01 – Theory and methodology of training
and education (Mathematics teaching methodology)

Field of science: Pedagogy

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GENERAL CHARACTERISTICS OF THE THESIS

The topicality of the subject and literature review. One of the main factors determining the effectiveness of the reforms carried out in the education system of the Republic of Azerbaijan is the high qualification and methodical skills of the teaching staff. Although these skills are mainly implemented in higher educational institutions, their main foundation is formed in the secondary school course. The work of training pedagogical cadres that meet the requirements of the modern era requires the improvement of the forms and methods of training in higher pedagogical schools.

It is apparent that teacher training, the stages of its implementation, the requirements that ensure the teacher's scientific and pedagogical training are constantly changing and developing. Unity in the world education system, ways for using new learning technologies in education management, and general rules for their improvement are implemented in a combined manner.

Necessary scientific innovations arising in the conditions of the information society, regardless of the form in which people perceive these changes, there are certain similarities as well as different trends. According to these analogies, the unique education policy of each state determines its economic, military and political potential. The development of the scientific and practical potential of the society, the high-level assimilation of modern scientific and technical achievements are closely related to mathematical education.

In the State Strategy for the Development of Education in the Republic of Azerbaijan, it is stated that: *"The education system of Azerbaijan should be economically sustainable and conform to the standards of the world's leading education systems"*¹.

¹State Strategy for the development of education in the Republic of Azerbaijan: [Electronic resource] / It was approved by the Decree of the President of the Republic of Azerbaijan dated October 24, 2013. URL: <https://president.az/az/articles/view/9779>.

Realization of intended goals and tasks is directly related to the level of development of mathematical education.

Training of mathematics teachers in accordance with the requirements of the information society, improvement of their professional activity and professional development system is always considered as one of the relevant topics. In the scientific-pedagogical and methodical literature, the studies conducted on teacher training can usually be divided into two groups.

The first of these refers to the general pedagogical and psychological problems of teacher training, their teaching methods and the organization of a methodical system related to them. At this stage, general pedagogical and psychological regularities related to all subjects are formed. Pedagogical, psychological and methodical problems of teacher training has been the focus of research, both by Azerbaijani (H.H.Ahmadov, A.A.Alizade, A.A.Aghayev, Y.Sh.Karimov, A.O.Mehrabov, A.Kh.Pashayev, A.N.Abbasov, F.A.Rustamov, H.A.Alizade, L.M.Gasimova, M.I.Ilyasov, Y.M.Azimzade and others), and Russian (V.V.Davydov, A.N.Leontev, I.Y.Lerner, M.I.Makhmutov, S.D.Rubinstein, P.M.Asadullin, M.I.Aldoshina, A.R.Batyrshina, I.F.Berezhnaya, N.S.Bogachyeva, V.K.Buryak, Y.K.Itin, I.A.Malanova, Y.N.Minuyuk, T.L.Kamoza, K.Krivotulova, S.N.Ryabtsov, Z.O.Shvartsman, S.B.Shedina and others) scientists, the problem has been analyzed and explained from various aspects.

In the second group, in addition to taking into account the special methodology in teacher training for specific subjects, existing problems and studies related to professional activity are considered.

The studies conducted in our Republic by B.A.Aghayev, S.S.Hamidov, A.S.Adigozalov, A.D.Zamanov, A.M.Mammadov, M.S.Jabayilov, F.N.Ibrahimov, Sh.T.Taghiyev, A.G.Pelangov, M.C.Mahmudov, T.M. Aliyeva, A.A.Guliyev can be attributed to the problem.

Among foreign scientists, Y.M.Kolyagin, A.A.Stolyar, Y.V.Vokhmina, A.V.Abramov, E.N.Alekseyeva, V.V.Bogun, V.A.Dalinger, M.V.Egupova, M.A.Isayeva, M.I.Lisova, I.E.Malova,

T.S.Mamantova, D.I.Yunisova, J.Kh.Ediyeva, E.N.Pryakhina, U.Selin and others conducted studies on the organization and problems of mathematics teacher training in various directions.

Scientifically and methodologically correct organization of the activities of students-future mathematics teachers in accordance with the conditions of the reforms carried out in the education system in the information society is considered one of the important issues.

General training of cadres for various types of educational institutions in mathematics teacher training in pedagogical educational institutions is a relatively complex process. The analysis of the literature and educational methodical materials written on this problem shows that the problems in the preparation of mathematics teachers for different types of educational institutions exist in most countries of the world, except for some countries (USA, Germany, Finland, etc.).

It is clear that different curricula and programs, textbooks and teaching aids are used in secondary general education schools, high schools (for students with special talents), and colleges. If we take into account the characteristics of the mathematics subject, we can say that solving the abovementioned problems is more difficult for this subject than for other subjects.

In the European education system, the individual characteristics of each of the abovementioned educational institutions are necessarily taken into account in teacher training. Special attention is paid to these principles even in the employment of graduates.

Starting from the 2014-2015 academic year, “Sabah” groups began to operate in the educational institutions of the Republic of Azerbaijan. These groups give to preference relatively higher scientific potential and competence in the selection of students.

The subject programs of the “Sabah” groups, which begin to operate from the second year, coincide with the special subject programs of the regular groups. This is a contradiction. The main goal of organizing such groups in foreign countries is to provide

teacher training for talented students. Different subject programs are widely used in these groups.

This approach to the abovementioned problem causes certain difficulties in the training of mathematics teachers for different types of educational institutions.

Formation of mathematics teacher training in all directions mentioned in scientific researches and methodological literature.

There are quite a lot of approaches proposed for this, and it is impossible to specify their number. These different approaches can be broadly characterized as follows:

- full formation of theoretical and practical knowledge of mathematics in secondary school education and higher pedagogical schools;

- creating the foundations of the professional-methodical theory of future mathematics teacher training.

According to the statistical data of the Ministry of Science and Education of the Republic of Azerbaijan, the State Examination Center (SEC), the quality indicators of high school graduates' exam results in mathematics are at a relatively low level compared to other subjects. This can be explained by various objective and subjective reasons. We believe that the most important of these reasons can be attributed to the lack of professional and methodological skills of the mathematics teacher.

Mathematics is of particular importance in the study of other subjects at all levels of education, especially in the secondary school course. From this point of view, the subject of mathematics should be considered as one of the most important subjects taught in secondary schools.

In the “Concept and Strategy of Continuous Pedagogical Education and Teacher Training in the Republic of Azerbaijan”, the system of teacher training, strategic activity directions, concept, requirements for teacher's professionalism and activity in the information society have been interpreted in a general form.

We believe that the specification of these issues in the field of mathematics, the problems of mathematical education and the ways to overcome them are relevant to the needs of the time.

At the same time, increasing the quality and efficiency of mathematical education indirectly creates ample opportunities for improving the quality of teaching other subjects. The subject of mathematics plays an exceptional role in the formation of the logical thinking of students, and in the improvement of judgment and understanding abilities. The activity of the mathematics teacher plays a special role for the realization of all these factors.

As a result of recent reforms in education, certain contradictions have arisen for one reason or another between the subject curricula of secondary schools and the mathematics programs of higher and further pedagogical educational institutions.

In order to increase the dynamics of development of mathematical education in our republic, the system of work on training of mathematics teachers should be established on the basis of modern requirements.

In none of the abovementioned research works, the system of work on the training of mathematics teachers in the conditions of the information society has been studied in a combined manner, in particular, a detailed analysis of the positive and negative features of the application of the use of information communication technologies in solving practical content issues in mathematics education has not been conducted.

The analysis of teaching and methodical literature shows that the problem of training of pedagogical personnel in the field of mathematics has always interested both mathematicians and methodical scientists, and conducting research in this field has always been in focus.

Contradictions between the needs of modern society and the current situation increase the relevance of the topic.

Having taken it into account, we believe that the problems of mathematics teacher training in the conditions of the information society in the rapidly changing modern world, in particular, the

substantiation of theoretical and practical materials from a scientific point of view in the organization of professional and methodical training of mathematics teachers can be considered as one of the relevant topics.

The object of the study is the training of teachers in higher educational institutions.

The subject of the research is the system of work on the training of future mathematics teachers in higher educational institutions in the conditions of the information society.

The purpose of the research is to determine the scientific-pedagogical, theoretical-methodical foundations of future mathematics teacher training in the conditions of the information society, to systematize the requirements for quality mathematics teacher training in higher pedagogic schools, and to create a new methodical system using modern training technologies.

Hypothesis of the study. In the conditions of the information society, quality mathematics teacher training depends on the academic ability, teaching experience and level of professionalism of professors and teachers, the necessary infrastructure, the content that ensures the qualification and professional training of the mathematics teacher, and the consideration of competence, creativity, technological, intuitive, genetic, and individual approaches in the content, effective forms and methods of training organization and effective use of new training technologies.

Tasks of research. Based on the purpose and hypothesis of the research, the following tasks are expected to be performed:

- to determine the scientific-pedagogical basis of future mathematics teacher training;
- to determine the reasons for the increase in the role and importance of mathematics in the information society;
- to analyze the current state of mathematics teacher training in a comparative manner, to group scientific and pedagogical problems;
- to reveal the place and role of logic and intuition in mathematics teacher training;

–to determine the requirements for the training of mathematics teachers in the conditions of the information society, to characterize the methodological features and principles;

–to determine the qualifications and professional competences that should be formed in future mathematics teachers;

–to reveal the possibilities and ways of using new pedagogical technologies in improving the quality of mathematics education;

–to form a new methodical system in mathematics teacher training.

Research methods. Based on the abovementioned assumptions, theoretical analysis and comparison of psychological, pedagogical, scientific and methodical literature related to the problem was carried out, questionnaire surveys were conducted among students, observation, analysis and synthesis, generalization, pedagogical experiment, mathematical-statistical and other methods were used.

The main propositions for defending the thesis:

1. The correct determination of the scientific-pedagogical, theoretical-methodical foundations of mathematics training is an important condition for the quality of future mathematics teacher training in the conditions of the information society.

2. Increasing the level of professional training of the future mathematics teacher is closely related to the socio-economic development and development of the society.

3. High-quality mathematics teacher training depends on professors and teachers who differ in their academic ability, teaching experience, professional level and modern approaches, necessary infrastructure, content that provides professional training of mathematics teachers.

4. High-quality mathematics teacher training depends on the correct selection and application of forms, principles and methods of organization of training in the implementation of content determined on the basis of state standards, and effective use of new training technologies.

5. Joint examination of functional dependencies between reasoning, logic, mathematical sophistry and intuition, their application in solving practical problems develops students' creative activities and increases their research abilities.

6. Analyzing the methods of providing mathematical information and analyzing it along content lines increases the intellectual activity (thinking, understanding, description, etc.) and skills of the future mathematics teacher.

Scientific novelty of the research. In the conditions of the information society, the scientific-pedagogical, theoretical-methodical foundations of future mathematics teacher training are determined, the requirements for quality mathematics teacher training in higher pedagogic schools are systematized, and a new methodical system is created using modern teaching technologies.

The theoretical significance of the study. In the conditions of information society, the work system on the training of mathematics teachers is theoretically examined in a complex way, and the scientific-methodical ideas and provisions developed will contribute to the development of the teaching theory of didactics, which serves to improve teacher training.

Practical significance of research. The correct organization of the work system for mathematics teacher training in the conditions of the information society consists of improving the content and quality of mathematics teacher training. The professional methodical competence of the mathematics teacher was formed according to the structural basis and the fields of practical application were indicated. The methods and approaches proposed here can be used in the preparation of methodological tools and recommendations for mathematics teachers and in the preparation of practical tasks.

Approbation of the research. Regarding the results of the research, 16 articles have been published in journals recommended by the High Attestation Commission under the President of the Republic of Azerbaijan, and in international and national conference materials.

8 of these articles have been published in journals and 8 have been included in the conference materials (5 of them international and 3 republic). 3 of the journal articles were published abroad, including one in a journal with an Impact factor included in the ERIH PLUS international index. 5 of the international conference materials have been published abroad.

The institution where the thesis was performed. The dissertation work was implemented at the “Mathematics and its teaching technology” department of the Azerbaijan State Pedagogical University.

Structure of the dissertation. The dissertation consists of an introduction, 10 paragraphs covering two chapters, a conclusion, a bibliography and appendices.

Introduction - 9 pages, 15410 characters; the first chapter - 53 pages, 90599 characters (1.1-6 pages, 12112 characters; 1.2-12 pages, 21340 characters; 1.3-18 pages, 27021 characters; 1.4-17 pages, 30126 characters), the second chapter - 71 pages, 120151 characters (2.1-9 pages, 16673 characters; 2.2-7 pages, 12025 characters; 2.3-18 pages, 31222 characters; 2.4-12 pages, 22829 characters; 2.5-15 pages, 24629 characters; 2.6-10 pages, 12772 characters), the conclusion - 4 pages, 6088 characters, the total volume of the dissertation consists of 153 pages, 232252 characters.

THE MAIN CONTENT OF THE THESIS

The first chapter of the dissertation, called “**Scientific-pedagogical foundations of future mathematics teacher training**” consists of four paragraphs.

In the first paragraph of this chapter entitled “*The role and importance of mathematics in the information society*”, the role and importance of mathematics in meeting the development and needs of society has been justified, the opportunities and connections of mathematics in the development of other fields of science have been

studied for different periods, the requirements for the basic concept (purpose and content) of mathematical education have been examined. Ways of realizing the requirements for the preparation of textbooks in the development of mathematical education have been studied.

In the second paragraph entitled “*Scientific and pedagogical problems of mathematics teacher training*” pedagogical personnel training in our Republic and foreign countries and related problems have been classified in a general form, the results obtained in the researches of pedagogical scientists engaged in this field and the proposed approaches have been compared and analyzed.

Here, the internal components of additional creative activity (skills of pictures, drawings, descriptions of geometric figures, construction of graphs, etc.) specific to the professionalism and competence of the mathematics teacher in the researches of mathematical pedagogic scientists have been listed and analyzed.

Also, taking into account the characteristics of the subject of mathematics, the levels of professional and methodological competence of future teachers have been analyzed from a methodological point of view, the importance of mathematical intuitive skills in the organization of the teaching process has been listed, the essence of the concepts of “flexibility” and “non-linearity” in mathematics education was clarified, the possibilities of using information and communication technologies in training have been methodically analyzed. It has been proposed to give priority to the use of ICT in training and, if necessary, to build logic-based models.

The third paragraph of this chapter is called “*The state and comparative analysis of mathematics teacher training in higher educational institutions of the Republic of Azerbaijan*”.

The main goal of this paragraph is to analyze the real situation of teacher training in higher educational institutions of our Republic and to provide effective proposals for solving existing problems. In the statistical data of the State Examination Center (SEC)² and the

² Dövlət İmtahan Mərkəzi. Abituriyent jurnalı, 12, 2021. – 624 s.

Teachers' Recruitment Commission (TRC) of the Republic of Azerbaijan, it is noted that the indicators for the subject of Mathematics in the entrance exams of applicants and in the recruitment of teachers are lower than in other subjects.

Azerbaijan State Pedagogical University is considered one of the leading educational institutions in the training of pedagogical personnel in our republic. From this point of view, the state of providing subjects in 2014 and 2020 at ASPU, related to the high school course of mathematics in the curricula for the specialty of mathematics has been studied and a statistical analysis has been carried out.

In this paragraph, it has been justified that there are serious contradictions between the mathematics programs of the secondary school and the programs of the subjects taught in the mathematics course of the secondary school (Elementary mathematics, Mathematics teaching methodology (MTM) in the higher schools, in particular, the amount of hours allocated to the subjects taught in this direction in the higher schools is too small, and in this regard specific proposals have been made.

At the same time, the compatibility status of the subjects related to the high school mathematics course in the curricula of other educational institutions (Azerbaijan State Pedagogical University (ASPU), Baku State University (BSU), Sumgayit State University (SSU), Ganja State University (GSU) and Nakhchivan State University (NSU)) which train staff in the field of mathematics teaching in our Republic has also been analyzed.

The currently used curricula for the Mathematics teaching specialty of the abovementioned higher schools were approved by the Ministry of Science and Education of the Republic of Azerbaijan in 2020. The number of credits (hours) allocated to humanities (general subjects) and specialized subjects in the curricula of the Mathematics teaching specialty for all higher education institutions is approximately the same.

60 credits (660 hours) have been provided for Section III, Specialization: Elective subjects in all of the 5 mentioned educational

institutions, and the selection of subjects related to this subject block has been given to the relevant higher schools. The educational plans of each of the higher schools mentioned in this paragraph have been analyzed in a comparative manner and the result has been presented in table 1.3.5.

Table 1.3.5
Comparative analysis of curricula of higher schools

Higher schools	Amount of total audience hours	The number of subject hours related to the teaching of mathematics in the secondary school course	Subjects related to MTM: percentage	Elective: hours allocated to specialized vocational subjects	Elective: Subject hours related to the teaching of mathematics in the higher school course	Subjects related to MTM: percentage
ASPU-2014	2520	285	11 %	390	45	11 %
ASPU-2020	2310	270	11 %	660	60	9 %
BSU -2022	2325	495	21 %	645	330	51 %
NSU-2022	2432	482	19 %	692	274	39 %
SSU-2022	2370	330	13 %	660	120	18 %
GSU-2022	2100	420	20 %	600	240	40 %

Based on Table 1.3.5, we can say that there is basically no difference in the number of hours allocated to the subjects related to the teaching of mathematics in the higher school course in the curricula approved in ASPU in 2014 and 2020.

In the curriculum approved in ASPU in 2020 and currently in use, two subjects (“STEAM” - 10 credits, 105 hours of lecture; Inclusive education and personalized training (5 credits, 60 hours of lecture) have been included in the block of subjects of “Specialization elective”. We consider that these subjects should be not included in the specialization-vocational elective subjects block, but in the first subject block - General block of subjects.

Here, it is considered necessary to give priority to the subjects included in the block of specialization elective subjects belonging to the high school mathematics course.

In the fourth paragraph of this chapter entitled “*Logic and intuition as a leading tool in mathematics teacher training*”, the role and importance of logic and intuition in improving the quality of mathematics teacher training have been justified. Logic, its elements and application possibilities have been evaluated as one of the main means of determining the quality indicator of mathematics education. Types of intuitive approach (creative and application) have been considered in the stage of introducing mathematical concepts, solving equations and inequalities, and solving problems with applied content. In logic, quantifiers and the rules of their use have been applied to solving specific problems related to some content lines. Working examples related to the joint application of logic and intuition in the coordination of specialization and professional-methodical skills in mathematics teacher training have been solved and analyzed.

Chapter II of the dissertation is entitled “**Theoretical foundations and application possibilities of the methodical system for the training of mathematics teachers in the conditions of the information society**” and consists of six paragraphs.

The first paragraph of this chapter is called “*Characteristics and principles of modern requirements for mathematics teacher training in the conditions of the information society*”. Here, the principles of mathematics teacher training and the features of the subject have been mentioned, and the issues of raising the level of teacher training within these conditions have been examined. In particular, in the preparation of mathematics teachers, the importance of giving priority to methodological approaches in practical and methodical features, and the need to pay attention to the unity of psychological and pedagogical approaches have been brought to the fore. The role of mathematical sophistry in mathematics education and the approaches interpreted in the studies of Methodist scientists in this field have been analyzed and compared. The components of

the principle of variability and flexibility (creating the connection of necessary basic and specialty subjects, elective subjects in a systematic and flexible form), which are of special importance in the training of mathematics teachers, have been interpreted from a methodological point of view.

In the second paragraph, “*Methods of providing mathematical information and their analysis*”, the role of information in the development of society, the methods of receiving and providing information, and the importance of mathematical education in their codification have been generally explained. It is noted that not all of the information provided and obtained during the analysis can always be accepted as true information. Thus, the provision of information and its analysis in mathematics education can be formed based on the mathematical and logical thinking of the person receiving the information. Here, the types of information given in mathematics education have been classified regardless of the source.

The possibilities of applying the information given analytically and graphically in mathematics training in solving problems along content lines have been analyzed from a theoretical and methodological point of view.

In the third paragraph of Chapter II, entitled “Teacher's mathematical ability and the possibilities of its use in the teaching process”, the reasons for the contradictions between the goal and result in mathematics education have been analyzed, and the classification of the teacher's pedagogical abilities in teaching-methodical literature has been reviewed. Here, the problems arising from the characteristics of mathematics education have been examined, and the ways of forming the didactic (teaching), research and scientific-cognitive (academic) abilities of the future mathematics teacher have been determined in order to overcome them. In understanding the multitude of information, the relevance of the ability of the learners to analyze the information is deemed one of the main conditions, and the problem examples related to its application have been considered. In the teaching of mathematics,

compared to other subjects, the correct selection of information and the relative complexity of its logical analysis have been justified.

In the fourth paragraph of Chapter II, entitled “Application of pedagogical technologies used in mathematics education by content lines”, the approaches to the concept of pedagogical technology in scientific pedagogical and methodical literature have been analyzed and summarized, the opinions of Methodist scientists on their classification have been compared, and the possibilities of using technologies by content lines in mathematics education have been examined. Here, the issues of organizing pedagogical technologies, ways of using pedagogical modeling (design) and its stages have been explained.

The methods of using pedagogical technologies in mathematics training, the requirements given to them have been examined from different aspects.

It is noted that pedagogical technologies are not only evaluated as components of objects and technical tools, but it is more correct to evaluate them as the level of professionalism of the teacher in teaching mathematical concepts, the speech, the sequence of problem situation creation, the evaluation of the knowledge of the students and the compatibility of the given information with the knowledge levels of the learners.

At the same time, the combined relations of differentiated and individual training methods, which ensure the formation of the methodical system at a high level in mathematics education, have been considered.

The fifth paragraph of Chapter II is called “*Stages of Methodical System Formation in Mathematics Teacher Training*”. Here, the stages of the methodical system in the improvement of mathematics teacher training have been reviewed. The technology of connecting the components included in the methodical system, the methodological means of forming the professional-methodical competence of the mathematics teacher have been interpreted according to the content lines.

The last paragraph of this chapter is called “*Pedagogical experiment and its results*”.

The pedagogical experiment was conducted in three stages.

Azerbaijan State Pedagogical University, Sumgayit State University and Ganja State Pedagogical University were selected as the main research base of the experiment.

Phase I of the pedagogical experiment is called the determining phase. At this stage, the current state of mathematics teacher training in higher pedagogic schools, official documents, subject programs and teaching-methodical resources adopted for the organization of teacher training were reviewed.

In order to analyze the problem in detail, a survey was conducted with the students, consisting of two questions, as follows:

1. Is the theoretical and practical knowledge you have acquired in Elementary Mathematics and MTM subjects at the university sufficient for you to work as a teacher in the future?

A) yes B) no C) partially D) I have difficulty answering

2. Which content lines do you have difficulty solving tasks related to?

A) Numbers and operations B) Algebra and functions C) Statistics and probability D) Geometry E) Measurements F) none K) all

Regarding the first question, 111 out of 261 students who participated in the survey stated that the theoretical and practical knowledge they acquired at the university was sufficient for them to work as a mathematics teacher in the future, 25 stated that it was not sufficient, and 86 stated that it was partially satisfactory. 39 students stated that they had difficulty answering the survey. The activities of the students who had difficulty answering the survey can be attributed to their weak self-assessment skills. The comment written by one of the students who chose option B) of the first question during the survey (“No, if it were sufficient, why are we going to the course to prepare for the Teacher recruitment exam (TRE)?”) attracted our attention. However, the answers written by this student

in the written test (in stage III - the checking stage) were scientifically correct and methodologically relatively efficient.

We believe that self-criticism and self-assessment can be considered one of the main criteria for improving teaching performance.

In the second question of the survey, the students' answers to the questions about which content line they had difficulty solving were as follows:

1. Numbers and operations by content line, A) option: 11 people;
2. Algebra and functions by content line, B) option: 42 people;
3. Statistics and probability by content line, C) option: 108 people;
4. Geometry by content line, D) option: 51 people;
5. Measurements by content line, E) option: 2 people;
6. The number of students who claimed that they had no difficulty in solving exercises related to any content line - 42 people (option F);

7. The number of students who claimed that they had difficulty in solving exercises related to all content lines - 5 people (option K).

It is known that the initial foundation of personnel training is formed, at least partially, in the secondary school course. In this regard, we considered it important to identify problems related to the teaching of mathematics in the secondary school course.

Statistical data of the State Examination Center, statistical results of teacher recruitment always attract public attention. From this point of view, we decided to find out the opinions and suggestions of secondary school principals, and to analyze the attitudes of mathematics teachers towards the problem. At the same time, conversations were held with students about the level of interest of students in mathematics, the characteristics of problems arising in studying the subject, and the information provided by them was also analyzed.

The mentioned data were mainly carried out on the X and XI grades of schools 36, 47, 258 of Narimanov district, and 76, 280 of

Surakhani district of Baku city. Also, the results of the formative and summative grades of students in mathematics, physics, and chemistry of the mentioned classes were analyzed.

In addition, the students' Small scale Summative Assessment (SSA) and Large scale Summative Assessment (LSA) test tasks were reviewed. The opinions of mathematics teachers regarding the existing problems were studied. Analyses were conducted on content lines and topics. From the surveys conducted with teachers, we came to the conclusion that one of the main reasons for the low level of mathematical education was the presence of certain flaws in the design of programs and textbooks in mathematics. Thus, most of the practical exercises given in the textbooks are of an applied and creative nature. It is impossible for all students to master these types of exercises.

In our opinion, it is necessary to provide all students with the necessary initial (mandatory) knowledge, not to provide them with extensive information as future mathematicians. Therefore, special attention should be paid to these points in the design of mathematics textbooks, and it is important to take into account the age and knowledge levels of students.

The main goal of the analysis of summative test tasks was to analyze which sections (content lines) of mathematics students understand at what level in the secondary school course. Because it would not be correct to attribute these problems only to students. If any section (topic) is poorly mastered by students in mass, then this means that there are scientific and methodological problems in the activities of this teacher. From the analysis of summative tasks, we came to the conclusion that the sections that are difficult for students to master are especially the content lines “Geometry”, “Probability and statistics”.

After familiarizing themselves with the relevant educational and methodological documents in schools, a survey was conducted with the students in the following content:

What profession do you want to have?

1. Teacher

a) Mathematics b) Physics c) Chemistry d) History e) Others:

.....

2. Doctor
3. Engineer
4. Economist
5. Others:.....

The main purpose of conducting the survey was to determine the statistics of choosing the teaching profession, especially the mathematics teacher profession, of students who showed high results on the SSA and LSA tasks. The results of the survey are reflected in table 2.6.1.

Table 2.6.1

Results of a survey conducted among students on profession choices

№	Classes	Number of students	Number of students who want to become teachers	Percent - (%)	Number of students who want to become math teachers	Percent - (%)
Baku, School № 47						
1	10 ^{a, b, d, e}	122	7	5.73	4	57.1 %
2	11 ^{a, b, c, d, e}	121	8	6.61	2	25 %
Baku, School № 258						
1	10 ^{a, b, c, ç}	92	11	12	2	18.2 %
2	11 ^{a, b, c, ç, d}	119	20	16.8	2	10 %
Baku, School № 36						
1	10 ^{a, b, c, d}	108	12	11.1	3	25 %
2	11 ^{a, b, c, d}	80	9	11.3	1	11.1 %
Baku, School № 76						
1	10 ^{a, b, c, d}	96	10	10.4	3	30 %
2	11 ^{a, b, c, d}	85	8	9.4	2	25 %
Baku, School № 280						
1	10 ^{a, b, c, ç}	106	7	6.6	2	28.6 %
2	11 ^{a, b, c, ç}	101	6	5.9	1	16.7 %
	Total	1030	98	9.5	22	22.4 %

98 out of the 1030 students who participated in the survey, said they wanted to become teachers. 22 out of these 98, said they would choose mathematics teaching. The results of the SSA and LSA in mathematics of these 22 were analyzed. It turned out that the LSA results of these students in mathematics were not higher than those of other students and were as follows:

1. The number of students assessed in the 35-50 point range is 4;
2. The number of students assessed in the 50-70 point range is 12;
3. The number of students assessed in the 70-90 point range is 6.

The survey results revealed that the majority of students with high LSA results in mathematics choose economics and engineering professions. The large number of students in some classes can also be considered a factor negatively affecting the quality of education. For example, it was noteworthy that 40 students were studying in the X^d grade and 37 students in the XI^e grade of school No. 47 in Baku.

Considering the characteristics of the subject of mathematics, we can conclude that it is impossible to use individual and differentiated approaches in such classes.

Thus, at the decisive stage (stage I) of the experiment, we got acquainted with the real situation of the issues of teaching mathematics in both higher education institutions and secondary schools.

The second stage of the pedagogical experiment is called the educational stage and covered the 2022-2023 academic year. The goal of this stage is to prepare for the implementation of the proposed methodological system. At this stage, control and experimental groups were selected according to tradition. Seminar teachers of the experimental groups got acquainted with the purpose and structure of the experiment. It is known that in the Mathematics Teaching specialty, the MTM-1 subject is taught in the second semester of the third year, and the MTM-2 subject is taught in the first semester of the fourth year. During this period, the additional

information provided by the seminar teachers of the experimental groups on both general methodology and special methodology created ample opportunities for the improvement of students' creative activity. One of the main reasons for the increased interest was that the proposed practical exercises and methodological approaches were closely related to secondary school mathematics textbooks.

The third stage of the pedagogical experiment is called the verification stage and this stage covers the 2023-2024 academic year. In order to determine the result, test writing tasks consisting of various options were organized for groups. The tasks were selected from higher school mathematics textbooks and covered all content lines.

In order to test the methodological knowledge and skills of the students in the relevant grades related to the content lines in the high school course, they were offered to answer the following questions.

“The following tasks belong to which grade of the mathematics course content line, in what form can students be motivated to solve them and what effective solution method do you suggest? “

The high-speed formation of scientific and methodological skills in both control and experimental groups is a complex process. Thus, the analysis of the spiral structure of the content lines in mathematics by grade is relatively difficult from a methodological point of view, and this always leads to certain scientific discussions.

The analysis of the results of the pedagogical experiment was presented in appropriate tables using elements of mathematical statistics. The meaning of the parameters given in the Table is defined as follows:

1. N – number of students;
2. W_a – mode (the most frequently occurring marks in the same group);
3. p – the difference between two neighboring marks;
4. \sum - number of marks before mode;
5. f - the number of most repeated marks;

6. M_e – median and is determined by the formula $M_e = W_a + \frac{p \cdot (\frac{N}{2} - \Sigma)}{f}$;

7. σ – total sum of marks;

8. G - is the numerical average ($G = \frac{\sigma}{N}$);

9. $M_e - \sigma$ change tendency of the result.

The results of both stages for the experimental and control groups are presented in the tables below.

Table 2.6.2
Analysis of the results of the pedagogical experiment
(Experimental groups, stage I)

№	Group	Students N	Marks				W_a	Σ	f	M_e	σ	G	$M_e - G$
			2	3	4	5							
Azerbaijan State Pedagogical University													
1	2001	20	2	9	8	1	3	2	9	3.88	68	3.40	0.48
	2002	20	2	9	7	2	3	2	9	3.88	69	3.45	0.43
Sumgayit State University													
2	432	18	2	9	6	1	3	2	9	3.77	60	3.33	0.44
	426	20	3	9	7	1	3	3	9	3.77	66	3.33	0.44
Ganja State University													
3	401	23	4	12	6	1	3	4	12	3.63	73	3.17	0.46
	402	20	3	10	7	0	3	3	10	3.70	64	3.20	0.50
	401 MIT	23	2	11	9	1	3	2	11	3.86	78	3.39	0.47

Table 2.6.3
Analysis of the results of the pedagogical experiment
(Control groups, stage I)

№	Group	Students N	Marks				W _a	Σ	f	M _e	G	G	M _e -G
			2	3	4	5							
Azerbaijan State Pedagogical University													
1	2003	21	1	10	8	2	3	1	10	3.95	74	3.52	0.43
	2004	20	3	9	7	1	3	3	9	3.77	66	3.30	0.47
Sumgayit State University													
2	436	12	3	10	9	0	3	3	10	3.80	72	3.27	0.53
	427	16	1	8	6	1	3	1	8	3.87	55	3.43	0.44
Ganja State University													
3	403	22	3	11	7	1	3	3	11	3.63	72	3.27	0.36
	402 MIT	21	3	10	8	0	3	3	10	3.75	68	3.23	0.52

Table 2.6.4
Analysis of the results of the pedagogical experiment
(Experimental groups, stage II)

№	Group	Students N	Marks				W _a	Σ	f	M _e	G	G	M _e -G
			2	3	4	5							
Azerbaijan State Pedagogical University													
1	2001	20	1	7	9	3	4	7	9	4.33	74	3.70	0.63
	2002	19	1	7	9	2	4	7	9	4.27	69	3.63	0.64
Sumgayit State University													
2	432	19	1	7	8	3	4	7	8	4.31	70	3.68	0.63
	426	18	0	7	9	2	4	7	9	4.22	67	3.72	0.50
Ganja State University													
3	401	21	2	9	7	3	3	2	9	3.94	74	3.52	0.52
	402	20	1	9	8	2	3	1	9	4.00	71	3.55	0.45
	401 MIT	21	1	7	10	3	4	7	10	4.35	78	3.71	0.64

Table 2.6.5
Analysis of the results of the pedagogical experiment
(Control groups, stage II)

№	Group	Students N	Marks				W_a	Σ	f	M_e	G	G	M_e-G
			2	3	4	5							
Azerbaijan State Pedagogical University													
1	2003	18	1	9	6	2	3	1	9	3.88	63	3.50	0.38
	2004	16	1	7	6	2	3	1	7	4.00	57	3.56	0.44
Sumgayit State University													
2	436	20	1	10	8	1	3	1	10	3.90	69	3.45	0.45
	427	18	1	8	7	2	3	1	8	4.00	64	3.55	0.45
Ganja State University													
3	403	20	2	9	7	2	3	2	9	3.88	69	3.45	0.36
	402 RİM	21	2	10	8	1	3	2	10	3.85	71	3.38	0.47

The analysis of the results shows that at the initial stage (at the beginning of the experiment), the level of scientific and methodological skills (percentage of mastery) of students in both control and experimental groups is approximately the same. At this stage, the correct answers to tasks covering all content lines for both groups, regardless of their form, were 55-74%. Methodological explanations regarding the method of explaining these tasks to high school students in the groups were in the range of 45-65%.

One of the tasks proposed here required finding the area of a figure bounded by lines. Only 40% of the students solved this problem correctly, 25% did not solve it at all, and 35% solved it incorrectly. It is possible to solve the problem incorrectly, and this can be taken for granted, depending on the content of the problem. However, expressing the answer obtained in a negative form when calculating the area can be considered a serious flaw from both a scientific and logical point of view. In the incorrect solution to the problem (35% of the cases), 15 students expressed the area unit as a negative number.

The analysis of the results of the verification experiment shows that solving practical exercises based on logical analysis creates wide opportunities for the formation of scientific and methodological knowledge in students. One of the main problems is the lack of students' logical and judgmental skills in solving practical exercises.

In the verification writing work that we conducted in the control and experimental groups, 137 students participated in the control and 124 students in the experimental groups, a total of 261 students.

In the control groups, the correct solution of tasks was 62-72%, and the accuracy of methodological explanations was in the range of 65-74%. At this stage, there were certain improvements in the performance of students in the experimental groups. Thus, at this stage, the correct answers to tasks of the experimental group students were approximately in the range of 71-83%, and the correct answers to methodological explanations were 72-84%. The results of the pedagogical experiment show that while the success rate in the control groups varied between 76%-85% and the quality rate between 33%-42%, in the experimental groups these indicators varied between 85%-92% and 48%-58%, respectively.

The overall results of the experimental groups were 9-11% higher than the results of the control groups.

As a result of the pedagogical experiment, we can note the following:

1. When comparing the students' responses to the questionnaires with the answers they gave to the written test, we come to the conclusion that the self-assessment activity of the majority of students is high. Thus, the information about which content lines the students had difficulty understanding during the survey was partially confirmed by the results of the written test.

2. Although some of the students correctly solve the tasks related to some content lines, they cannot provide a methodological explanation for the solution.

3. They make certain mistakes when depicting spatial figures related to geometric content lines on a plane. For this reason, certain

problems arise from a scientific and methodological point of view in solving computational problems.

4. Both scientific and methodological errors are made when solving and explaining tasks related to statistics and probability.

5. Due to insufficient theoretical knowledge when applying mathematical rules and formulas in solving tasks, students make some mistakes, and this can be accepted as a natural phenomenon. However, not feeling that the result is logically incorrect confirms the weakness of mathematical and logical thinking of some students.

For example, expressing a number with an irrational number and answering the area with a negative number can be considered serious mistakes. We believe that it is important to pay special attention to these factors in improving the professional and methodological training of future mathematics teachers.

Summarizing the thesis following **conclusions** have been presented:

1. The stages of mathematics teacher training in the information society are a complex system and require a comprehensive approach. The components included in this system can be characterized in several ways. Specifically, this includes the activities of future mathematics teachers in educational institutions where they must undergo pedagogical practice, starting with the organization of vocational training in secondary schools. At the same time, the role of in-service training courses and the independent scientific and methodological activities of mathematics teachers can also be included in this system. The components included in the system are implemented on the basis of functional dependence, and a change in any of them is considered a prerequisite for the others.

2. The integration of training at all levels of education in our republic into the world education system has led to the emergence of new concepts, methodological and technological innovations, state standards and alternative curriculum plans, the design of the pedagogical process in a new form, the improvement of the quality of mathematical education and the improvement of the content of mathematics teacher training.

3. In the process of organizing mathematics teacher training in the information society, scientific and teaching-methodological relations between secondary schools and higher pedagogical educational institutions are insufficient, and it is important to ensure continuity between them.

4. The number of hours allocated to subjects related to the secondary school course in the curriculum of higher pedagogical educational institutions for the specialty “Mathematics Teacher” is not enough for students to work as mathematics teachers in secondary schools in the future. From the analysis of some curricula and subject programs, it can be concluded that the content of the existing curricula is more suitable for training students as mathematicians (scientists) rather than for their future work as mathematics teachers in secondary schools.

5. Secondary schools play a leading role in improving the professional training of mathematics teachers, and currently the general level of mathematics education in secondary schools cannot be considered acceptable. There are contradictions in content standards at both levels of education.

6. There is no information at all or only a small amount of information about the teaching of some topics in the content lines included in the secondary school mathematics course in the relevant subject programs of higher educational institutions. The main reason for this is the uneven balance in the number of subjects included in the curriculum and the distribution of hours allocated to them.

7. Modern requirements for the training of mathematics teachers serve to form students' skills in using ICT, and create an opportunity to apply theoretical knowledge of the specialty in practice. These processes occur mainly at the stages of receiving and analyzing mathematical information. The transformation of mathematical symbols into text and, conversely, the transformation of situations given in text and descriptions given in graphics into mathematical language creates conditions for the formation of professional and methodological competencies in students.

8. The use of information and communication technologies in the visualization (modeling) of situations in solving mathematical problems simultaneously develops students' cognitive abilities, increases their intellectual skills and leads to the development of their creative activities.

In particular, the systematic correction of errors that occur during the interpretation of the properties of some spatial figures and their depiction on a plane through computer programs intuitively solves the problems that arise. This approach also creates conditions for the development of students' mathematical thinking and spatial imagination.

9. In higher education institutions, the formation of professional and methodological abilities of future mathematics teachers in their specialty from a theoretical and practical point of view is carried out mainly in the teaching of the subjects "Elementary Mathematics" and "Mathematics Teaching Methods".

The number of hours allocated to the teaching of these subjects is small compared to other subjects, and it should be borne in mind

10. It was found out that students encounter certain difficulties in mastering the topics related to the content lines "Geometry", "Statistics and Probability" and in providing methodological explanations during their solution. While only 116 hours are allocated for teaching the content line "Statistics and Probability" in grades V-XI in secondary school, only 4 hours (2 hours of lectures and 2 hours of seminars) are allocated for teaching this content line in the subject of MTM in higher education.

11. Logic, intuition, mathematical sophism develop students' professional methodological skills, create conditions for making the right decisions in accordance with the situation. Individual and differentiated approaches in the process of applying these components create the basis for the development of students' theoretical and methodological knowledge related to the specialty.

Based on aforementioned conclusions, **following suggestions and recommendations** have been made:

1. In the development of new curricula for mathematics teaching, the number of hours allocated to subjects related to the secondary school mathematics course should be increased and additional theoretical and practical subjects related to secondary school programs should be included.

2. In the secondary school course, in the entrance exams of applicants and in the hiring of teachers, the test method is used as an evaluation criterion. The specificity of the subject of mathematics requires that a mathematics teacher must have excellent theoretical and methodological knowledge of testing tasks.

In our republic, with the exception of BSU, students in other universities on the specialty of mathematics teacher education are either not given information about the methods of compiling and solving test tasks, or they are given information in a superficial form. We believe that it is necessary to include the subject “Methodology of compiling and solving test tasks in mathematics” in the relevant curricula of other universities in the block of professional subjects “Elective specialty”.

3. In organizing the professional training of students, conditions should be created not only for the preparation of personnel in mathematics for secondary schools, but also for the preparation of pedagogical personnel for colleges and lyceums. For this, the subject programs of the “Sabah” groups, which begin to operate from the second courses on the basis of selection at universities, should be different from the subject programs of other bachelor groups and their content should be relatively broad from a scientific and methodological point of view.

4. The work experience of some foreign countries (Czech Republic, Germany, Poland, USA, Great Britain, etc.) in the training of pedagogical personnel should be thoroughly studied, especially the activities of some institutes operating in those countries (“Institute of Teacher Training and Advanced Training”, “Institute of Theory and Methodology of Teacher Training”, “Institute of Teacher Education”) should be examined in detail, and the corresponding rules should be implemented in Azerbaijan.

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

1. Mammadova, A.M. Application of geometric elements in the study of content lines / – Baku: Institute of Education of the Republic of Azerbaijan, Scientific works, – 2019, No. 2. – pp. 138-140.

2. Mammadova, A.M. Logical issues in mathematics teaching / – Baku: Baku Girls' University, Scientific works, – 2020, No. 3. – pp. 42-45.

3. Mammadova, A.M. The role of logic elements in mathematics teaching / III International Symposium on Innovative Technologies in Science and Education, Baku, – 25 May 2021. – pp. 77-83.

4. Mammadova, A.M. On the function of mathematics teacher training / “Physics and mathematics education: Realities, requirements and perspectives”. Republican scientific conference. Baku, – 22 November, 2021, – pp. 24-29.

5. Mammadova, A.M. Types of information in mathematics teaching and their use / Republican scientific conference “Training of pedagogical personnel: modern approaches and trends”. Baku, – 10 December, 2021, – pp. 144-149.

6. Mammadova, A.M. Features of training future mathematics teachers in the information society / Materials of the XXV Republican scientific conference of doctoral students and young researchers, – Baku, – 23-24 November 2022. – pp. 171-174.

7. Mammadova, A.M. Applications of mathematical abilities in the training process / – Baku: News of the Pedagogical University. Mathematics and natural sciences series, – 2023, No. 3. – pp. 57-64.

8. Mammadova, A.M. Forms of organizing a methodological system in the training of mathematics teachers / Baku: Institute of Education of the Republic of Azerbaijan, Scientific works, – 2023, No. 5, – pp. 177-180.

9. Mammadova, A.M. Ways of forming the professional and methodological competence of a future mathematics teacher / – Baku: Baku Girls' University, Scientific works, – 2023, No. 2. – pp. 98-101.

10. Mamedova, A.M. Innovative approaches of scientific and educational complexes for training professional specialists and scientists / European Academy of Natural Sciences (Hannover) Innovative strategies for the quality of scientific research and development: problems and solutions (Proceedings of the International Scientific and Practical Conference) – St. Petersburg, January 18-19, 2023. – pp. 183-190.

11. Mammadova, A.M. Application of pedagogical technologies in mathematical education/ Digital transformation of education: States and prospects, Proceedings of the II International Scientific and Practical Conference, – Makhachkala, June 30 - July 2, 2023. – pp. 203-209.

12. Mammadova, A.M. Systematization of innovations by area of activity / European Academy of Natural Sciences (Hannover) Innovative and technological development based on management qualities: problems and solutions (Proceedings of the international scientific and practical conference) – St. Petersburg, November 9-10, 2023. – pp. 186-191.

13. Mammadova, A.M. On methodological problems of training mathematics teachers / – Moscow: Acmeology of development 2024. Methodological and methodological problems. Collection of articles, 2024, Issue 44. – pp. 79-85.

14. Mammadova, A.M. The role of logic and intuition in mathematics teacher training / – Baku: Qedim Diyar, – 2024, Vol. 6. – pp. 88-91.

15. Mammadova, A.M. Application of different technologies in mathematics teacher preparation / – Berdyansk: Scientific notes of the Berdyansk State Pedagogical University, – 2024, No. 2. – pp. 105-113.

16. Mammadova, A.M. On professional and methodological principles in the preparation of a mathematics teacher / Modern concepts of education development: problems, realities and prospects. Collection of materials of the I Scientific and practical conference (with international participation). – Makhachkala, May 24-25, 2024. –pp. 84-89.

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