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Possibilities and ways of using new information technologies in teaching mathematics related to informatics (for III-IV grades)

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Field of science: Pedagogy

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ABSTRACT

of the dissertation submitted
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GENERAL CHARACTERISTICS OF THE STUDY

Relevance and level of development of the topic: The educational reform carried out in the independent Republic of Azerbaijan in the 90s of the last century, and the Education Program developed based on its documents defined the reconstruction of education in higher and secondary schools, including mathematics. In modern conditions, a new structure and content approach to the teaching of subjects at school requires a new preparation, a new approach from both the teacher and the learner. The problem of the realization of education requires new didactic and methodological approaches. The most important of these is to provide students with real-life knowledge and practical application.

The urgency of the problem in the realization of interdisciplinary relations is to prepare the young generation at the life requirements level in the modern scientific conditions and technical progress and intensification of integrative relations between sciences. *“As a result of integrative processes, social changes in science, production, and human labor activity have revealed some contradictions in the subject teaching system at school. The acquisition of complex knowledge, skills, and habits by students in the learning process has made it necessary to realize the aspect of interdisciplinary communication”¹*

To form students' worldview, complex knowledge based on concepts, topics, scientific factors related to different subjects and serving the set goal should be used. Creating conditions for the formation of scientific knowledge is the realization of interdisciplinary relations in training based on didactic requirements.

Based on psychological and pedagogical research, it has been determined and substantiated that interdisciplinary relationships are reflected in the objectives, content, methods, tools, organizational

¹ Maksimova V.N. Interdisciplinary connections in the educational process of the modern school. M., "Education", 1982, 185 p.

forms, and results of training. Therefore, the didactic problem of interdisciplinary relations makes it necessary to identify the interrelationships between the educational, upbringing, and developmental functions of interdisciplinary relations. Research in this area requires synthesis, generalization, and a comprehensive approach.

It is necessary to reveal integrative connections in the process of teaching different subjects and thus to create a unified system of applied knowledge about the real world in students. Thus, the integrative function of school subjects is to establish interaction between them in the teaching process and should be based on the relevant theoretical concept.

Researches on the history of the problem are reflected in works by: Q.I. Baturina, Ş.İ. Ganelin, İ.D. Zveryev, P.M. Ivanov, P.Q. Kulaqin, N.M. Kazimov, A. Mehrabov, F.A. Rustamov etc. Starting from the 70s of the last century, the problem of interdisciplinary relations has become an important direction in didactics.

The introduction and application of the Education Program as a state document show that the integration process in school education is continuing rapidly at the present stage. The application of electronic technology in education has necessitated the rapid application of ICT.

The teaching of various subjects in secondary schools should serve the formation of a general outlook in students and the mutual acquisition of acquired knowledge, and integrative learning is brought to the realization of interdisciplinary relations in a specific context.

Scientific-research - methodological and theoretical issues of the implementation of integrative learning in the pedagogical literature are noted in two directions:

1. Interdisciplinary connection within the framework of integrative training - refers to subjects that are conceptually - theoretically and methodologically relevant.

2. Integrative learning is carried out between subjects that do not fit into the conceptual content of the subjects but are interrelated in a given integration.

The first direction, which is suitable for the related teaching of mathematics and computer science in III-IV grades, was considered acceptable. That is, the related teaching of mathematics and computer science within the integrative learning model is based on the compatibility of their conceptual theoretical content and methodology.

Constructive opinion on this belongs to I.S.Antonov. *“Interdisciplinary communication is a construction of the content of teaching material that belongs to two or more teaching subjects, the main features of which are as follows:*

- *content elements (communication objects) determine the connection between the objects in terms of meaning and the connection in terms of structure;*

- *The methods used to create appropriate relationships between subjects and forms of teaching;*

- *integrated use of knowledge in the formation of skills and habits in solving educational problems”*

An analysis of the interdisciplinary relationship from different perspectives allows it to be defined as follows: *“An approach that determines the semantic compatibility of conceptual and methodological approaches in the learning process between two or more subjects”*.²

The methodological bases of realization of interdisciplinary connection in integrative training are defined as follows:

1. Teaching areas intersection of disciplines and common research methods in the implementation of interdisciplinary relations. For example, literature and history, chemistry and physics.

2. The realization of interdisciplinary relations arises from the general methodological possibilities of the taught subject.

² Antonov, I.S. Integrative function. Modern problems of the MPM // -Moscow: "Education", - 1985, - 235 p.

The methodological role of interdisciplinary relations in integrative learning is related to its didactic capabilities. Because integrative learning - the formation of a scientific worldview in students in the learning process - tries to solve such a task. This necessitates a creative approach to understanding the world around us. New forms, methods, and approaches in modern teaching have a profound effect on the nature and didactic direction of interdisciplinary relations. This can be explained by the rapid application of modern electronic technology in our lives and the application of information and communication technologies in the learning process.

“A modern high school graduate should have basic knowledge, be able to use information resources creatively, and solve vital issues³. Therefore, the goals of modern computer science training are defined as follows:

- 1) transfer and acquisition of knowledge,
- 2) acquisition of skills and habits in the process of information research,
- 3) use the acquired knowledge and skills in the acquisition of new knowledge and based on all this to create an image of the surrounding world.

In this regard, the relationship between computer science and other disciplines, including mathematics, has reached a new stage. The application of modern teaching methods plays an important role in the realization of this connection. The teaching of mathematics in connection with computer science forms in students the coordination of theoretical and practical knowledge and the motor skills of students necessary for the use of electronic means.

In the methodological literature, interdisciplinary communication and interaction are generalized as interdisciplinary relations. Therefore, the following important issues are considered when studying interdisciplinary relations:

³ Zarovnyayeva, V.T. f. "Distance and Virtual Learning" // - Moscow, -2009, №10

- to study the specifics of the integration of different scientific systems,
- the study of integrative features of various sciences is brought to the fore.

In integrative learning, especially in the process of teaching mathematics and computer science, the formation of students' worldview should be in the center of attention as an important scientific and methodological issue.

Our research refers to three principles on which interdisciplinary communication is based:

- 1) Theoretical bases of interdisciplinary communication,
- 2) methodological bases of interdisciplinary communication,
- 3) the basics of the worldview of interdisciplinary communication.

There are two types of interdisciplinary relationships:

1. Natural relations between subjects and their realization,
2. Scientific and methodological contacts to improve the quality of teaching subjects and the level of knowledge acquisition.

Realization of integration between sections of mathematics means realization of integration between such lines of content. There are two aspects to consider here:

- 1) intensification of teaching material content,
- 2) broadening their understanding of the concept of "unified mathematics".

Interdisciplinary integration is realized in two ways:

- integration between content lines
- realization of integration between mathematics and other disciplines, for example, physics, astronomy, chemistry, biology. In this case, the nature of the application of mathematics takes precedence.

At the present stage, new pedagogical technologies allow improving the quality of students' mastery. Thus, it is more important to select and apply appropriate issues in the process of teaching mathematics.

The concept of integration has two meanings:

- a) to provide students with a mature, holistic view of the world around them (learning objective),
- b) creation of a common basis (platform) for coordination or convergence of knowledge (teaching aids).

As a means of teaching - what should integration give the student?

- a system of knowledge that connects different parts of the world,
- create an idea that the universe is one or complete.

The object of research is the process of teaching mathematics related to computer science in III-IV grades.

The subject of research. These are the methods and tools used to realize the purpose of the research in the learning process.

The purpose of the study. The purpose of the research is to develop a methodological system of teaching mathematics and computer science in grades III-IV and to achieve school experience.

The objectives of the study are as follows:

- To study the psychological, pedagogical, and methodological possibilities of studying mathematics related to computer science in III-IV grades of primary school;
- To reveal the essence and purpose of the problem of realization of interdisciplinary communication in the process of teaching mathematics and computer science courses and to clarify the level of development of the problem;
- To study, analyze and generalize the problem of interdisciplinary communication in the existing scientific and pedagogical literature during mathematical training;
- To study the possibility of using students' algorithmic, modeling, programming skills in primary school mathematics lessons;
- To develop forms of organization of these lessons and methods of conducting them by modern requirements;
- To test the expediency of ways and opportunities to use the knowledge and skills of students in the field of computer science during the teaching of the elementary course of

mathematics through pedagogical experiment, to determine its validity.

Research methods: Observation, comparison, generalization, the study of school documents and advanced school experience, analysis of psychological-pedagogical and methodical literature, and pedagogical experiments were used as research methods in the dissertation.

Defensive provisions:

- There are many psychological, pedagogical, and methodological opportunities for the interrelated study of mathematics and computer science in grades III-IV.
- The establishment of interdisciplinary integration within the framework of the basic standards on the content lines of mathematics and computer science at the level of primary education is an important condition for increasing the effectiveness of training.
- The specification of the principles and methods of related teaching between mathematics and computer science in III-IV grades leads to the strengthening of modeling and algorithmic aspects in mathematics teaching.
- When new information technologies are used in the teaching of mathematics related to computer science, students' intellectual activity, attention span and interest in learning mathematics increase.

The scientific novelty of the research. The study identifies the content of teaching mathematics related to computer science in III-IV grades of secondary schools and identifies the use of integrative teaching methods, organizational methods, and tools in mathematics and computer science. Opportunities and ways of new information technologies have been studied and a new methodical system has been developed.

Theoretical significance of the research From the preparation of theoretical - methodological and methodical bases on the teaching of mathematics related to computer science in III-IV grades, the

introduction of computer science concepts in the teaching process of these classes activates students' mental thinking skills, influences their worldview, develops analysis and inference skills.

The practical significance of the research is to apply the developed methodology on the use of new information technologies in the teaching of mathematics related to computer science in III-IV grades as a methodical material in school practice and the faculty of primary education.

Approbation of the research and application of the results to the training practice. The general provisions of the dissertation were regularly reported at the Department of Pedagogy and Methodology of Education of Ganja State University. In connection with the content of the dissertation, the following articles were published in periodicals recommended by the HAC, reports were presented at international and national scientific and methodological conferences, and the text was published.

The dissertation was prepared at the Department of Pedagogy and Methodology of Education of Ganja State University.

During the research, mathematics, and computer science standards, textbooks, and teaching aids for primary school students were analyzed. Then scientific-research, pedagogical-psychological, and methodical literature was analyzed in connection with this problem and mathematics and computer science lessons in primary classes (Ganja city school-lyceum N^o. 27 named after I. Mammadov, Ganja city secondary school N^o. 9 named after A. Pushkin, Tovuz village school, village school of Goy-Gol region, etc.) experience was studied and generalized.

Structure of the dissertation: The dissertation consists of an introduction, three chapters, a part of the pedagogical experiment, conclusions, and suggestions, and a list of references.

The dissertation consists of (263254 characters), title page (501), table of contents (4589), introduction (20901), dissertation content (232256), conclusion (5083), list of used literature, and appendices.

MAIN CONTENT OF THE DISSERTATION

The **introduction** indicates the urgency of the problem, the purpose, and object of research, subject, objectives, hypothesis, research methods and provisions, the scientific novelty of the research, the theoretical and practical significance of the tasks are substantiated and the structure of the research is approved.

The **I chapter** of the dissertation is called *Theoretical scientific bases of interdisciplinary relations in the context of integration of sciences* and consists of six paragraphs. The **first paragraph**, entitled *The essence of mathematics as a science and its role in life*, provides views on the role, importance, and content of mathematics in modern life, the application of mathematics. Leonardo da Vinci assessed the role of mathematics in the study of nature: *“No human research can be considered a real science if it has not been mathematically proven.”*⁴

It is through mathematical methods that the theoretical and practical problems of the environment are studied. Thus, current scientific, technical, and economic problems are solved by mathematical methods. Thus, mathematics as a science has become a productive force in society. At the same time, the value of mathematics as science is determined not only by its practical application but also by the fact that it is an independent science. This shows the place and role of mathematics in life. In this section, we have considered the tasks of mathematics from a scientific, practical, pedagogical and methodological point of view.

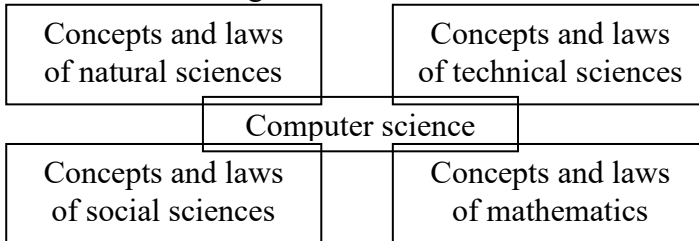
In the second paragraph, entitled *Informatics as a science*, the place of computer science in the system of sciences is shown schematically and explained.

Computer science is a relatively young science, applied in various fields of human activity, and the main technical means is the computer. The emergence of the computer cannot be considered the beginning of the emergence of computer science as a science.

⁴ Leonardo da Vinci. Selected works of natural science // - Moscow, - Academy of Sciences of the USSR, - 1955, - p. 172

Computer - an advanced and multifunctional technical mechanism of various computing devices used by humans as a computing device

The place of computer science in the system of sciences can be described in the following scheme:



The third paragraph is entitled ***Integration in education and informatization of education*** and consists of 2 items. Integration - as a scientific concept - entered the educational or pedagogical process in the 80s of the XX century. During this period, integrative processes took place all over the world in science, politics, economics, and many social spheres of life.

The essence and relevance of the integrative approach in education are aimed at increasing students' cognitive activity, interest, and initiative. Linking math to other subjects actually means linking math to life.

The process of informatization in education is closely related to the tasks facing informatics as a science and a subject. The content of informatization of education includes the objectives of informatics training. Informatization of primary education, first of all, the coordination of mathematics and computer science in the form of a single process - is a very important issue today.

The fourth paragraph is entitled ***Theoretical and worldview bases of interdisciplinary relations*** and the paragraph was divided into two items.

Based on the research, the following areas can be noted:

1. Methodological bases of integration of sciences,
2. Logical and gnostic bases of integration of sciences,

3. Integration in teaching subjects.

Based on the analysis of scientific and methodological literature, the following conclusions can be drawn:

- 1) the methodological feature of interdisciplinary relations in the integration of sciences is the principle of the unity of theory and method;
- 2) methodology of sciences – tells about the system of principles and methods related to the studied areas of science;
- 3) in the process of integration, axiomatic and formal methods of forming scientific knowledge intersect.

Integration between sciences makes it necessary to realize interdisciplinary connections and relations. The unified picture of the world created based on different sciences leads to the emergence of a unified scientific understanding developed based on differentiation and integration as a whole. As a result of integration, the cognitive laws of one science are applied to other scientific fields.

Interdisciplinary integration - serves to form the knowledge and skills of students, to expand their worldview, when there are common concepts in the content of different subjects, or when there are opportunities to apply mathematical knowledge in other subjects. For example, in grades I-IV, the integration between the Geometry content line and the Measurements content line is an interdisciplinary integration that realizes the possibility of applying theoretical knowledge in practice.⁵

The fifth paragraph is entitled ***Integrative relations and composition of mathematics and computer science.***

The relationship between computer science and mathematics is determined by two principles of computer design of number systems and the idea of Boolean algebra. Number systems are related to the

⁵ Orujova, S. S. The social necessity of interdisciplinary communication. // - Baku: ASPU. News of ASPU, - 2015. №2, - pp.424-426

concept of natural numbers, and Boolean algebra is related to the applied arithmetic operations.⁶

The concept of computational systems is the idea of forming ideas about the quantitative characteristics of objects and events, which is shown in mathematics to be related to the emergence and formation of the concept of numbers. Thus, a computer that performs calculations quickly works on a binary number system. This is natural. Because the operating system of the electronic device of these machines is based on the coding of signals in a binary system. The binary system, which is the logical basis of the computer, corresponds to the basis of the logical system.

As students become familiar with the concepts of the mathematics course in the relevant classroom, they are introduced to the concepts and computer terms necessary in computer science teaching, taking into account the principle of succession and the need for interdisciplinary communication.

The last sixth paragraph show the analysis of the educational-methodical literature *Analysis of teaching-research works related to the problem*, computer science books of III and IV grades. Each topic is considered separately and certain shortcomings are taken into account, some parallels are shown with the textbooks of Mathematics.

Chapter II is entitled *Theoretical and methodological issues of research* and consists of five paragraphs:

The first paragraph, *Mathematics and Informatics as Subjects in Primary Education*, was divided into two items. The paragraph provides information on the goals and objectives of teaching mathematics in grades I-IV. As a subject, although the mathematics course for grades I-IV consists of five content lines according to the Curriculum, the use of their integration in the learning process was emphasized. Given the content lines of computer science and their

⁶ Orujova, S. S. Integrative relations and structure of mathematics and computer science. // - Baku: Institute of Education Problems of the Republic of Azerbaijan. Scientific works, - 2019, - p. 86. №4, - pp. 96-99

description, the Education Program shows that the knowledge and skills acquired by the student at the end of the third grade and the knowledge and skills at the end of the fourth grade almost coincide.

Increasing students' cognitive activity in the teaching of mathematics related to computer science is given in the second paragraph.

Interdisciplinary integration plays an important role in increasing the effectiveness of the lesson. Because, unlike computer science, other interdisciplinary integration plays an important role. Because, unlike computer science, the number of hours per week allocated to other subjects is large. In this regard, there are more opportunities in mathematics. Interesting, entertaining, and partly logical exercises should be used in math or computer science classes to ensure cognitive activity. Thus, control over the implementation of relevant work, the optimal rhythm and mode of work should be expected.

The methods used to ensure the cognitive activity of students in the learning process are of great didactic importance.

In mathematics, students' cognitive activity is related to a specific task presented to them. Because the questions in the assignment make the student think.

The third paragraph is entitled ***Principles applied in the teaching of mathematics related to computer science. What is inheritance in training?*** named. The concept of "inheritance" is known in science, theory of education, and upbringing. In the scientific literature, the essence of succession is defined as follows: *"Nature is always in motion, moving forward and never stopping, denying the old, not only the new but continuing, developing and completing its beginning."*⁷

The principle of inheritance can be realized between the mathematics courses of the primary grades, between the mathematics course of the IV grade, and the mathematics course of the V grade. It

⁷ Коменский, Я.А. Сочинения педагогических трудов. // - Москва: «Просвещение», - 1965, - 524 стр.

is known that the realization of inheritance between knowledge - mainly manifests itself in the process of solving problems.

The fourth paragraph "Features of teaching information technology and computer science course in primary mathematical education identifies the following:

1. Information technology in primary mathematical education,
2. Teaching computer science course in primary school requires features.

The teaching features of the course of information technology and informatics in primary mathematical education were as follows:

1. Theoretical and practical aspects the definition of the preparatory stage consists of defining the aspects included in the content.
2. Application of information and communication technologies in the educational process. The effectiveness of training depends on the proper use of computers and information technology. The presentation in PowerPoint begins with a demonstration on the big screen, and the author also uses various illustrations.
3. Computer testing - If the teacher applies the test method, she compiles the test herself.
4. Form of work with electronic encyclopedia - Everyone tries to get faster and more information from different media.
5. Computerization of children's educational institutions - It is known that in this process, the computer strengthens the motivation of students. The use of multimedia tools (color, graphics, sound, video) allows to model different situations and events.

The application of educational multimedia electronic programs and their connection with traditional teaching methods, the application of pedagogical innovations increase the effectiveness of training.

The fifth paragraph is entitled ***Features of related teaching of mathematics and computer science (grades III-IV)*** and consists of two items. In this section, the integration of computer science in the process of implementing the content lines of the mathematics course of grades I-IV is explained by the fact that the content lines of the

course are purely mathematical. In this regard, we use the closeness and similarity of the scientific and methodological issues of these two subjects in our school practice.

In computer science and mathematics, the meaning of the concept of the algorithm for both subjects was clarified. The types of activities of students in the teaching of mathematics with the application of information technology were considered. Since mathematics and computer science courses have common concepts, a system of general questions has been defined for the implementation of interdisciplinary relations.

Chapter III of the dissertation is entitled *Realization of teaching mathematics in connection with informatics* and is divided into five paragraphs. The first paragraph is *The use of ICT technologies in mathematics lessons. Application of the project method*. ICT technologies are used in modern life not only in education, but also in all spheres of production. This shows that from the very beginning of training, the use of information and communication technologies is not only necessary, but also an integral part of the educational process. The leading subjects of school education: the mutual and interrelated activity of the teacher and the student is the essence of this process.

The partial collapse of the seriously centralized form of the education system has led to the emergence of new methods and creative initiatives. Given this aspect, the application of a concept called the project method in teaching is gaining momentum. Students acquire skills and habits through hands-on design work as they learn. In the design process, students also face certain difficulties in various life situations and must look for ways and means to overcome them.

The curriculum also includes design skills in the list of education quality parameters. For this reason, the section discusses the functions and development of the design method.

Use of mathematical knowledge in the study of the elements of computer science is the title of the second paragraph. Algorithm, model, modeling, algorithm construction, analysis, synthesis, generalization, concretization, number systems, canonical

representation of numbers, etc. used in mathematics and computer science. The requirements for a modern school are to master the basics of knowledge, to achieve their application in life, and practice to acquire relevant skills and habits. To have these qualities, it is necessary to strengthen the independent cognitive activity of students. Various programs and examples are shown for the related study of the above elements. It reviewed the content of the course "Mathematics + Computer Science" for grades I-IV.

The third paragraph is *The concept of the algorithm in mathematics and computer science (grades III-IV)*. Here the analysis of the concept of the algorithm in mathematics and computer science training (III-IV grades) were carried out. Information about the algorithmic language was given, methods of giving the algorithm were considered.

The fourth paragraph is *Development of general teaching skills in computer science classes* and examples of lessons on how the teaching of computer science in primary school contributes to the formation of general teaching skills and habits accompanied by elements of information components are considered. Depending on the content of individual lessons, students have the opportunity to teach elements related to computer science.⁸

The last paragraph deals with *"ICT application training of primary school teachers."* Examples of the application of the computer in the pedagogical activity of the teacher in different stages of training were shown, and the stages were as follows:

1. At the stage of acquiring new knowledge
2. The stage of strengthening new knowledge
3. The stage of testing students' knowledge, skills, and habits
4. Involvement of students in design activities

⁸ Оруджева, С.С. Использование инновационных элементов в обучении информатики совместно с элементами математики, с использованием новейших технологий. // IV Международная научно-практическая конференция «Психолого-педагогические проблемы современного образования: пути и способы их решения», - Дербент: - 2021(27 февраля), - стр. 276-281

The pedagogical experiment was conducted in three stages (defining, teaching, checking) to check the degree of effectiveness of the methodical system presented based on the object, purpose, hypotheses proposed in our research. Each stage has goals and objectives.

Following the problem of the research, a comparison of the methodological system developed by the author is found in the learning process and the necessary adjustments are justified.

To test the effectiveness of the methodical system dedicated to the teaching of mathematics related to informatics in III-IV grades of primary school in 2014/2015, 2015/2016, 2016/2017, 2017/2018 academic years, a three-stage pedagogical experiment was conducted in some urban and rural schools.

As a result of the implementation of interdisciplinary relations, we assessed the level of students on four levels based on the ability of students to speak, judge, coordinate events, draw conclusions, classify events, apply mathematical knowledge in computer science.

Each level first determines the accuracy of the student's knowledge of both subjects and their relationship.

The results of the inspection carried out at the defining stage

Table 1.

Schools	Classes		Number of	Answers (by levels)			
				I	II	III	IV
Qazax r. Gazakhbeyli v. school	Control	III	18	1 (5,6%)	4 (22,2%)	6 (33,3%)	7 (38,9%)
		IV ^a	16	-	2 (12,5%)	5 (31,25%)	9 (56,25%)
Dashkasan r. Molla Hasanli v. school	Control	III	14	-	2(14,2%)	7(50%)	5(35,8%)
		IV ^a	19	1 (5,2%)	3 (15,8%)	5 (26,3%)	10 (52,7%)
Goy-gol r. Chayli v. school	Experi	III	20	1 (5%)	5 (25%)	4 (20%)	10 (50%)
		IV	19	1 (5,3%)	3 (15,8%)	7 (36,8%)	8 (42,1%)

Tovuz r. Ashagi Qushchu v. school		IV ^a	21	-	3 (14,3%)	8 (38,1%)	10 (47,6%)
		IV ^b	19	-	5 (26,3%)	5 (26,3%)	9 (47,4%)
Ganja city, school N ⁰²⁷	Experimental	III ^a	30	3 (10%)	4 (13,3%)	10 (33,3%)	13 (43,4%)
		III ^b	28	2 (7,1%)	3 (10,7%)	9 (32,2%)	14 (50%)
		IV ^a	29	1 (3,4%)	3 (10,3%)	9 (31,1%)	16 (55,2%)
		IV ^b	27	2 (7,5%)	5 (18,5%)	7 (25,9%)	13 (48,1%)
Ganja city, school N ⁰⁹	Control	III	20	1 (5%)	3 (15%)	8 (40%)	8 (40%)
		IV ^a	24	1 (4,2%)	3 (12,5%)	8 (33,3%)	12 (50%)
		IV ^b	21	-	4 (19%)	5 (23,8%)	12 (57,2%)

The results of the written work carried out at the inspection stage
Control and experimental classes

Table 2.

Schools	Classes	Number of	Answers (by levels)				
			I	II	III	IV	
Qazax r. Gazakhbeyli v. school	Control	III	18	2 (11,1%)	4 (22,2%)	5 (27,8%)	7 (38,9%)
		IV	16	1 (6,3%)	2 (12,5%)	6 (37,5%)	7 (43,7%)
Dashkasan r. Molla Hasanli v. school	Control	III	13	1(7,7%)	3 (23,1%)	4 (30,8%)	5 (38,4%)
		IV	18	-	3 (16,6%)	5 (27,8%)	10 (55,6%)
Ganja city, school N ⁰²⁷	Experimental	III ^a	30	10 (33,3%)	8 (26,7%)	7 (23,3%)	5 (16,7%)
		III ^b	28	7 (25%)	7 (25%)	10 (35,7%)	4 (14,3%)
		IV ^a	33	11(33,3%)	10(30,3%)	9 (27,3%)	3 (9,1%)
		IV ^b	27	9 (33,4%)	8 (29,6%)	8 (29,6%)	2 (7,4%)
Ganja city, school N ⁰⁹	Experimental	III	20	2 (10%)	4 (20%)	10 (50%)	4 (20%)
		IV ^a	25	2 (8%)	6 (24%)	12 (48%)	5 (20%)
		IV ^b	21	3 (14,3%)	5 (23,8%)	9 (42,9%)	4 (19%)

Goy-gol r. Chayli v. school	Control	III	20	4 (20%)	8 (40%)	6 (30%)	2 (10%)
		IV	18	3 (16,7%)	5 (27,8%)	6 (33,3%)	4 (22,2%)
Tovuz r. Ashagi Qushchu v. school		IV ^a	21	3 (14,3%)	8 (38,1%)	7 (33,3%)	3 (14,3%)
		IV ^b	19	2 (10,5%)	5 (26,3%)	7 (36,9%)	5 (26,3%)

Let's carry out a comparative analysis of the results of the pedagogical experiment.

At the defining stage of the pedagogical experiment, the results of the control and experimental groups did not differ significantly from each other. For example, if we compare the numerical facts in Table 1, we can note the following results:

Level I answers for rural schools on average: 4 out of 146 pupils (3%) answered in the affirmative. In urban schools, 6% of 179 pupils answered in the affirmative.

68 pupils of rural schools (47%) did not give a satisfactory answer. 49% of urban schoolchildren answered inadequately.

The results of the written work performed at the third test stage of the pedagogical experiment:

Of the 131 students in the control class, 11 (approximately 8%) answered the first level. Level 4 respondents: 42 people out of 131 (approximately 32%).

Of the 196 pupils in the experimental classes, the number of level 1 respondents was 49 (about 25%), and the number of inadequate answers was 28 (about 14%).

The need to create integrative ties in the implementation of the content lines of both subjects in grades III - IV is the most important pedagogical approach to improving the quality of knowledge assimilation.

Comparative analysis of the experimental results showed that both the percentage of success and the percentage of quality in the experimental classes with the quality of assimilation were 14-18% higher than in the control ones. This shows that the use of innovation, integration, interactive teaching methods in modern

education improves the quality of both individual and integrative teaching in school subjects.

The study led to the following conclusions:

1. Informatics is a young science for both secondary and higher education, and the goals of its teaching are primarily to prepare the younger generation for life and practical activities. Realization of education in this context requires new scientific and methodological approaches in teaching the subject. The interpretation of rapidly evolving computer science and concepts related to information technology requires the improvement of the existing methodological system.

2. Requirements for algorithmic and information culture of students, computer literacy - in terms of content should be reflected in school education of computer science. The theoretical knowledge, practical skills and habits provided should provide that training. In school practice, there are two approaches to teaching computer science courses:

- a) algorithmization, programming - modeling;
- b) modeling, algorithmization and programming,

In our practice, we prefer the first approach.

3. Computer science - is mainly based on the mathematical apparatus, so the course of mathematics plays an important role in the general education of students and the professional training of students in computer science. Therefore, the integrative teaching of these two subjects is very important. The implementation of interdisciplinary links between mathematics and computer science in primary school serves two purposes:

- helps to increase the effectiveness of training,
- Provides practical connection of students' mathematical training.

4. Modeling, algorithmization, formation, programming, which are important concepts of the mathematics course, are working concepts of computer science. Thus, being an algorithm-efficient process in mathematics, and writing (description) of this process in a certain language in computer science plays the role of a model of

activity. In computer science, the algorithm is performed by a computer. Algorithmization is the process of obtaining an algorithm and describing it in an algorithmic language. The mathematics course focuses on the "syntax" of the studied algorithms and their creation and application, rather than an accurate description of their structure. It is necessary to pay more attention to the "syntax" of algorithms in mathematics teaching. This helps to strengthen the connection between the two subjects:

1) increase the attention to the "syntax" of algorithms in the related teaching of mathematics and computer science,

2) strengthening the modeling aspect.

5. As the content of mathematics and computer science courses of III-IV grades of secondary schools is integrative, it is necessary to apply existing and interactive teaching principles and methods in teaching common concepts in the process of realization of interdisciplinary relations in their teaching process.

6. Application of classical and modern principles and methods of interdisciplinary communication in the process of teaching mathematics and computer science courses on innovative bases:

1) provides in-depth mastery of both subjects,

2) demonstrates the vital applications of mathematics on the example of computer science,

3) affirms the unity of scientific knowledge to understand the scientific landscape of the world.

7. Provides the formation of students' cognitive thinking through the study of the didactic basis of the combined teaching of mathematics and computer science in the III-IV grades of secondary schools - the study of the concepts of formalization, algorithmization, modeling, programming using technical means of computer science. Interdisciplinary integration - reveals the practical application of scientific knowledge and thus ensures the formation of practical skills and habits.

8. The application of interactive teaching methods in the related teaching of mathematics and computer science courses increases the ability of students to apply heuristic-logical approaches,

necessitating the use of thinking operations such as analysis, synthesis, generalization, abstraction, concretization.

The integration of scientific knowledge also penetrates the content of the disciplines of the relevant sciences and actualizes interdisciplinary relations and their implementation. The teaching of mathematics and computer science in grades III-IV expands students' theoretical knowledge. The application of computer tools improves the quality of mastering by forming their practical skills and habits related to computer technology.

9. Since mathematics textbooks in secondary schools (including primary school textbooks) are based on a sequence of content lines, the implementation of interdisciplinary and interdisciplinary links is almost out of the question.

10. Novelty and theoretical significance of the research:

Concretize the principles and methods of teaching mathematics related to computer science and strengthen the modeling and algorithmic aspects of mathematics - confirms the idea.

The results of the pedagogical experiment, based on scientific and methodological sources, logical approaches - prove the accuracy and validity of the research results.

The main provisions of the dissertation are shown in the following theses and articles:

1. Orujova, S.S. Application of ICT in mathematics lessons in primary school // International Conference on "Mathematics and application of ICT". - Ganja: GSU, - Part II, - 2014, - pp.133-136
2. Orujova, S.S. Methodological issues of the preparatory course of computer science // - Baku: ASPU. ASPU news, - 2015. №1, - pp. 441-444
3. Orujova, S.S. The social necessity of interdisciplinary communication. // - Baku: ASPU. News of ASPU, - 2015. №2, - pp. 424-426
4. Orujova, S.S. On the development of mathematical thinking of young schoolchildren // - Baku: ASPU. ASPU news, - 2015. №3, - pp.482-484

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7. Orujova, S.S. On the teaching of mathematics and computer science in primary school. // I International People's Scientific Conference of Young Scientists, - Ganja: GSU, - Part I, - 2016, - pp.328-330
8. Orujova, S.S. On integrative issues of mathematics and computer science // Republican Scientific Conference on "Quality assurance in higher education". - Lankaran: Lankaran State University, - 2016, - pp.325-326
9. Orujova, S.S. Application of heuristic methods in teaching computer science in primary school / S. S. Orudzheva, A. A. Aslanov // Monografia Pokonferencyjna, "Rowyspos obrozwoju pedagogika", - Poznan (PL): - 2017, - pp.138-140
10. Orujova, S. S. Integrative relations and structure of mathematics and computer science. // - Baku: Institute of Education Problems of the Republic of Azerbaijan. Scientific works, - 2019, - p. 86. №4, - pp. 96-99
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13. Oruchova S.S. Features of teaching information technology and the course of computer science in primary mathematics education. // - Ganja, Ganja branch of the Azerbaijan National Academy of

Sciences. Newsletter, series "Pedagogical Sciences", - 2021, p.1.
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