

REPUBLIC OF AZERBAIJAN

On the rights of manuscript

ABSTRACT

of the dissertation for the degree of Doctor of Philosophy

**A METHOD FOR TEACHING GEOMETRICAL MATERIALS
USING ICT IN TRAINING OF MATHEMATICS
(in X-XI classes)**

Specialty: 5801.01-Theory and method of training and
education (a method for training of mathematics)

Field of science: Pedagogics

Applicant: Shahin Mutarif oglu Aghazade

Baku-2021

The dissertation work was carried out at the Department of “Mathematics and its teaching technology” of Azerbaijan State Pedagogical University.

Scientific supervisor

Prof. Dr. of Pedagogy

Abulfat Gulam oglu Palangov

Official opponents:

Dr. of ph. and math. sci., prof.

Rahim Mikayil oglu Rzayev

Dr. of Pedagogy

Associate professor

Monsum Adil oglu Alshov

PhD in Pedogogy

Associate professor

Khalida Sidgali kizi Hasanova

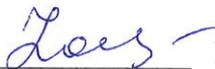
Dissertation council FD 2.15 of the Higher Attestation Commission under the President of the Republic of Azerbaijan at the Azerbaijan State Pedagogical University

Chairman of the Dissertation council: Prof. Dr. of History sciences

Jafar Mammad oglu Jafarov

Scientific secretary of the Dissertation council: PhD in Pedogogy,

Associate professor



Malak Alislam kizi Zamanova

Chairman of the scientific seminar:

PhD in Pedogogy,

Associate professor



Khumar Tofiq kizi Novruzova



GENERAL CHARACTERISTICS OF THE WORK

The topicality and using of the theme. Since the formation of human society geometrical knowledges have widely been used in solving practical problems. Long before our time the problems of measurement of areas and volumes were solved with various mathematical accuracy. It is considered that mathematics as a science has been formed before our time in VII-VI centuries. During this period Thales school was formed and started to systematize the current geometric knowledge. In the formation of Geometry as a science there are special contributions of ancient greek mathematicians. For example, a prominent member of Pythagoras school a scientist named Hippocrates wrote a book called "Geometry". Before our time in the V-IV centuries the Platon school in ancient Greece had a great service in development of Geometry. Afterwards, the Greece scientist Euclidean in the III-II centuries before our time wrote the book "Elements".

We can note the results of researchers I.N.Antipov, E.B.Ashkinize, G.A.Baranovskiy, B.B.Besedin, G.D.Gleyzer, Y.G.Guzuna, V.A.Dalinger, A.P.Ershov, V.M.Monakhov, V.M.Mayorov, N.A.Sidirov, P.A.Kormilov, E.Y.Smirnova, V.P.Dyakonov, P.I.Sovertkov, Paul Andrews, Andreas Ryveb, Kirsti Hemmib, Judy Sayersa, Adnan Baki, Hayal Yavuz Mumcu, Fatih Karakush, Temel Kosa and others on the problems of using school pupils of secondary schools.

We can prove ancient history of development of geometry in our country, by "Gobustan rock paintings". In formation of teaching of geometry in secondary schools the scientists A.M.Mammadov, A.S.Adigozalov, Kh.S.Hasanova, A.G.Palangov, A.M.Gasimova, S.S.Hamidov, N.A.Aliyev, M.J.Mardanov, S.S.Mirzoyev, M.H.Yagubov, E.A.Gasimov, M.J.Mahmudov, G.Z.Verdiyeva, Sh.A.Hamidova, Z.F.Kazimov had major services.

Prominent pedagogies like N.A.Abishov, I.N.Ismayilov, M.A.Alishov, H.H.Ahmadov, I.B.Ahmadov, H.N.Tagiyev,

S.J.Jabrayilzade, M.V.Abdullayeva have conducted significant research on the use of ICT in the educational process in our country.

On the other hand educators like F.A.Rustamov, I.N.Isayev, I.H.Jabrayilov, H.A.Alizade, psychologists A.A.Alizade, R.İ.Aliyev and others have led interesting research on modern teaching methods.

The pedagogical, psychological and methodical analyzes of current literature indicate that, the interpretation of Geometric content line in X – XI forms doesn't meet the modern requirements. That is why the theme of the investigation is actual.

According to curriculum system a numerous problems appeared in the interpretation of geometry materials in math textbooks can be classified like this:

1. Geometry is a deductive science.
2. Isolation of geometrical content line from other content lines.
3. Calculational character of tests as seen in admission exams.
4. Relative difficulty in mastering theoretical parts of the materials of geometric content lines.
5. Poor knowledge of a great majority of secondary school teachers of the materials of these content lines (since 1991 to now).
6. Necessity of bringing new mathematical information resources to the education process.

For realizing the stressed notes it is necessary to improve the teaching methods of Geometric content line and interests of students towards Geometry.

In order to implement these novelties, one of the necessary means is application of Information Communication Technologies (ICT) in teaching. But application of ICT in teaching must be of individual character, i.e. in teaching each topic on geometry different means of ICT must be adjusted to concrete situation. It also should be noted that to each topic of geometric content line, ICT must be applied with various mathematical approaches only in this way we can make obvious the abstraction of geometric materials, to color pictures, to change easily their forms, make them more understandable and accessible.

According to the observations, we concluded that one of the causes of poor assimilation of the materials geometric content lines by pupils is

that there are some problems in creation interest to this discipline. In former times, in order to arouse interest in this field the forms of geometrical figures were created (especially of space figures) and they were distributed in schools. So, the pupils could see and touch these figures. But now these figures are used little as the rapid development of engineering enables the application of ICT enables to illustrate figures visually in electronic board and in computer. It should also be noted that when using ICT along with traditional figures it becomes possible to teach more complex figures and characteristic features of combinations of these figures to pupils.

Though there is a rather sufficient number of methodical references in teaching of geometry, there is no sufficient methodic system in this field. We have a sufficient number of means and methods for their use in elementary grades. But in higher grades such methodical system for working with textbook distributed at the request of new curriculum has not been established yet. Auxiliary textbooks in addition to manuals aren't enough to cope with these works.

In 2008-2012, thanks to the "State Program on informatization of education system in the Republic of Azerbaijan", new results in the development of education in the country different from former ones in level, were obtained. Implementation of measures in this field, is one of the works done on development of normative and methodic base in using ICT in education. At present, it is obvious that in the absence of passage to higher technologies in teaching geometry course in X-XI grades, this method does not justify itself. If this method is not applied to stereometric figures there arises a more complicated situation in teaching. To make pupils to feel this at some period is in great extent depends on teacher's professional teaching ability.

Control of teaching by ICT, processing of data in a new form, is an obvious sign of a whole teaching system providing to teach new knowledges with spending less time.

Application of teaching programs to teaching process by means of a computer is of new essence. The teaching program is one of the pedagogical means and executes the followings:

- to form knowledge, skills and habits and to control them

- information-inquiry
- summarizing and assessment.

Every teacher must use these features of teaching programs skillfully, in a creative way.

The law of the Republic of Azerbaijan “On Education” adopted in 2009, reflects education legislation, its duties, education rights of citizens, main state principles in this field. Application of ICT in education is one of the today’s problems influencing on formation of a new generation of Azerbaijan citizens with modern knowledge and skills. Therefore, teaching world standards in our Republic is one of the priority directions put forward. It is not accidental that there exists an order of President of the Republic of Azerbaijan on affirmation of “National Strategy in information and communication technologies on behalf of development of the Republic of Azerbaijan” intended for 2003-2012.

At present, the skills of specialists with ICT in all the spheres of including education and their proper use is of great importance. To master ICT in secondary schools is an important factor to pass the self-development stages in future. In its turn it can contribute to teaching geometric content line.

At present, one of the important ways to learn geometry with ICT is an effective use of a computer. Note that according to statistics, 20 years ago, age limit of computer users was 20, now this age is 5. The main causes are that computational technologies are widely used, increase in the number of computers for a person and the number of programs applied for solving the given problems. Experiments show that the use of computer programs gives rather positive results in eliminating problems arising when applying stereometric problems.

With all these researches, we should note that in our Republic ICT is widely used in studying problems in this field including opening of geometric content line. As shortcomings begin in relatively junior classes, in 2013 for the first time in secondary schools in the manual “Mathematics” for the fifth grade, in the book authored by Nayma Gahramanova, Famil Huseynov published in 2016 were made important changes. Incompatibility of mathematics book authored by Nayma Gahramanova, Mahammad Kerimov to curriculum based program and

no ICT use increases attention to this field. In accordance with retraining and change of books there is a great necessity to elaborate a new methodic system.

Object of studies is teaching process of the topics of geometry content line using ICT in X-XI grade of secondary schools.

Subject of research is to extend solution methods of problems in teaching mathematics including geometric content line by using ICT, to use offline and on-line programs in teaching themes, to increase logical judgment skills, to discuss the obtained results with pupils.

The goal of the research along with increasing the quality of teaching in secondary schools is to learn the lesson by means of various programs influencing on time save, directed to understanding lesson in an entertaining way, and influencing simple perception of pupils, increasing motivation

Assumption of the research: For teaching Geometric content line in X-XI forms using ICT means widely it is possible to compile educative programmes. Also it is possible to improve teaching methods by using them. With increasing students' interests towards learning the content of the training and education materials. It is likely to advance the quality of their math knowledge.

For proving the truth of research's assumption it is considered very important to solve these problems.

- The Math programmes of X – XI forms or sub programmes to critically analyse and rework some parts related to the problems
- To critically analyse the textbooks and scientific methodical literature related to problems
- Improving the ways of Geometric content line's progress by using computer technology in class
- Taking pedagogical experiments for aim of valuing the newness brought to science by organised methodic system and generalising gained results
- Visualising the graphics used in internal and among subjects

- Compiling the educative programmes for flourishing the teaching methods of Geometric content line in X – XI forms and defining the rules used in training process

The methodological base of research is formed from pedagogical and psychological facts, the theory of the study, comprehension and modification system of problems.

Research methods. In the research observation, comparison generalization, experiment, statistics, analysis –synthesis, induction and deduction and other active training methods were used.

Scientific innovation of research: A new materials has been developed for the use of modern information technologies in the streometry section of the geometric content line and the technology for its use has been developed.

Theoretical importance of research: Pedagogical – psychological conditions for teaching geometry content line streometry section using modern information technologies have been defined.

Practical importance of the research: Determining potentials of ICT in teaching geometric content line, to conduct lesson by computers sequentially, from simple to complex, symmetric (base increment in each grade) is of practical importune. In such a teaching methodology, the pupils weak in stereometry became active, technical habits of pupils by visualization principle develop. Along with upper grade pupils, the secondary school teachers also can use this work.

The basic defended theses are the followings:

1. It possible to improve the system teaching of geometric content line by ICT in the X-XI grades.
2. Organization of methods by means of ICT in teaching geometric content line is more efficient in solving stereometric problems.
3. An appropriate database for right use of stereometric problems by means of composed computer programs must be chosen. For example, solution of some problems of sphere and cone on the base of different data.
4. To choose an approach by means of not one concrete program, but by a needed equipment according to situation in certain form.

Stages of the research. The research stages were conducted on a control system and was regularly continued in the following way:

- Pedagogical-psychological and scientific methodical analysis of the problem was carried out, comparisons, changes related to the problem between Azerbaijan and the countries with close education system were analyzed and pedagogically estimated, without leaving the main line, some results for increasing quality of teaching were obtained.
- methods and ways for the goals, duties in executing the research work were determined, and topics corresponding to this work were generalized and revealed;
- references were analyzed, general results obtained from observations and experiment were analyzed;
- the level of estimation of pupils knowledge and skills, level of development of their abilities and habit were completely studied;
- convincingness and objectivity of the research results is provided by theoretical analysis of the problem, the results of pedagogical experiments affirming the main theses of the work in the quality level are positively estimated by the teachers and participants participating in the experiment.

Approbation of the research. The dissertation work was executed at the chair of “Mathematics and its teaching method” of ASPU. The main results of the work were reported at the scientific conference “Information technologies in teaching geometric content line” (Perm, 2015), the XII International scientific-practical conference “Scientific studies and education” (Moscow 2015), at the International conference devoted to 85-th jubilee of the outstanding scientist and public figure, corr. member of ANAS, State Prize Laureate, honored scientist, former rector of BSU, doctor of phys.-math. sc. prof. Yahya Mammadov (Baku 2015), the Republican conference “Functional analysis and its applications” devoted to 100 years of honored scientist, prof. Amir Shamil oglu Habibzade (Baku 2016), Proc. of XX Republican sci. conference of doctoral students and young researches (Baku 2016), the Republican sci. conference devoted to 93 years of the national leader Heydar Aliyev “Actual problem of mathematics and mechanics” (Baku 2014), the Republican scientific conference “Actual problems of

mathematics and mechanics” devoted to 94 years of the national leader of Azerbaijan Haydar Aliyev (Baku 2017), the Republican scientific conference “Actual problems of mathematics and mechanics” devoted to 100-th jubilee of corr. member of ANAS, the know scientist and outstanding mathematician, doctor of physic-mathematical sciences prof. Goshgar Teymur oglu Ahmedov (Baku 2017), the Republican scientific conference “Actual problems of mathematics and mechanics” devoted to 95-th jubilee of the national leader of Azerbaijan Haydar Aliyev (Baku 2019), the international conference devoted to 90-th jubilee of acad. Azad Khalil oglu Mirzajanzade (Baku 2018).

7 scientific papers and 11 abstracts were published.

Personal contribution of the author: The author`s personal contribution is the choise of purpose and direction of research. In addition, all the result obtained and the cordination of research methods belong to the authors.

Publications: The main result of the dissertation work 18 articles in thr reccomended journals of The Higher Attestation Commission under the President of Respublic of Azerbaijan, 10 of them without co-authors, as well as 6 articles in periodical published in international summary and indexing systems. The number of published articlrs on thr results of national and international scientific events is 11 (2 of them abroad).

The structure and scope of the dissertation are determined by the logic of the research and the sequence of solving the tasks. The dissertation consists of an introduction, three chapters (Chapter I - 82246, Chapter II - 86151, Chapter III - 10543), results, a list of 170 references and 1 appendix. The total volume of the work is 150 pages (229923 characters).

THE MAIN CONTENT OF THE WORK

In introduction the urgency of the problem is justified, the research object, its subject, goal and duties, supposition, methodological base, research methods, novelty of the research, theoretical and practical importance of the work, the theoretical and practical importance of the work, the represented theses are stated and brief information about the research of results is given.

Chapter I of the dissertation work is called **“Theoretical problems in application of ICT in teaching geometric content line”** and consists of 3 subchapters.

The first subchapter of chapter 1 deals with help of ICT in modern time its main development points and contribution of this line to disciplines. This field was divided into three parts: before 1900 years, after 1900 years “Slow development of education sphere”.

Subchapter 2 of chapter 1 deals with psychological properties of ICT use in mastering geometry content line in the X-XI grades, the arising problems, the role of rapid development of mathematics in many professions (in many of them), more use of “geometric content line”. In subchapter 3 of chapter 1 scientific works close to this dissertation work and published in Azerbaijan, foreign countries were compared, its elaboration aspect was underlined. taking into account features of computer programs, some teaching programs were given.

Chapter 2 of the dissertation work is called **“A technique for teaching geometric content line in X-XI grades”**. This chapter consists of 3 subchapters.

In subchapter 1 of chapter 2 we study if there is a tool for studying space figures constituting the base of X-XI grade by means of Cabri 3D and opinions of teachers were revealed, first computers of these programs, their application to education, computer instruction, computer aid, education resource, multimedia, computer learning resources, profit and restrictions were explained.

In subchapter 2 of chapter the more deep objects of ICT in teaching geometric content line, relation of application of teaching programs with programs were revealed, typical character of explained computer programs for our country was underlined.

In subchapter 3 of chapter 2 relation of ICT with geometric content line, was given and it was justified that this relation and also education structure is not always from general to proper, but the another method with probability teaching ability, the method from proper to general may be education oriented.

Chapter 3 of the work is “**Organization of pedagogical experiments and scientific analysis of their results**”. here the experiment part takes place and this studies working of pupils and secondary school teachers teaching this discipline with ICT equipment’s, their skills, help of these equipments to them, use of ICT means in teaching, the features that differ with their positive and negative properties.

“**Pedagogical experiment and its results**” is given at the end of chapter 3.

To verify the truth of the supposition and using ICT when teaching mathematics at the X-XI grades of secondary schools, to provide efficiency of a technique for teaching geometrical materials we have organized pedagogical experiments.

The pedagogical experiment implemented at certain stages covers 2015-2018 years and is of great importance in studying the level of mastering of geometric content line by pupils, in deep research of theoretical problems arising in applying ICT in this sphere. In the beginning of our presentation, to justify the stated assumptions from practical of view we prepared a methodical system in teaching “geometric” content line (X-XI grades) and implementation of teaching process, application of ICT and determined the school where the experiments would be carried out the exchanged ideas, made conversations with mathematics teachers of these schools and distributed teaching materials with necessary presentations to them. We note that pedagogical experiment was carried out in the following schools by dividing into experimental and control classes.

1. Baku, school numbers 109, 158, 254;
2. Ismayilli region schools №3 and 5, M.Azimov Tazakend complete secondary school;
3. Ganja school №2, 3, 31.

Furthermore, covering different years, pedagogical experiment was carried out in the following succession:

Stage 1-2015-2016 years.

Stage 2 2016-2017 years.

Stage 3 2017-2018 years.

In order to determine how the pupils of X-XI grades implement extension and depth of space imaginations, application problems of ICT in description, comparison by means of inductive and deductive approaches, generalization, abstractization, the level of concretization level, the use of logical elements in justification process, to differ condition, data and on offer to be proved in proof problem, how to implement the use of “technology” in the process of solution of a geometric problem the exercises were introduced to the pupils of X-XI grades.

Furthermore, account of psychological preparation of teachers participating in the experiment, the role of psychological aspects in teaching of mathematics and its influence on pupils successes was highlighted. It is necessary to note that the exercises introduced to the pupils were adequate to the program of that class and was chosen according to the purpose of the program.

In some special cases, the following were introduced to the content of exercises:

1. Studying urgent problems of the use of the notion “technology” when solving mathematical problems.

2. Determining advantages arising in application of “technology” when solving mathematical exercises.

3. Clarifying application of theoretical knowledge to a concrete situation, compliance of theoretical and technological knowledges of a pupil when solving a problem;

4. Application of generalization and analogy, formation of analysis and synthesis skills of pupils.

5. Working with mathematical symbols and progress from proper to general;

6. To solve the problems not by habits but by exploring, to implement mathematical simulation in a more effective way.

As a result of solution of such problem, with knowledges, rules and at the same time using the computer graphics, the pupils are acquainted with discovery of theorems and relations. For example, the problems of finding lateral sides, full sides and volume of a pyramid, a cut pyramid, geometrical place of points in the surface and space and problems of geometrical transformations are of great importance according to didactic functions.

To attain the goal of our research, the pedagogical experiment was carried out at several stages and we can divide it into the following categories:

It consisted of reveal the level of logic judgment, comparison and generalization of abilities, width and depth of space thinking, ability for solving nonstandard problems with no concrete data or letter data, to determine the level of their psychological state, the ways for developing mathematical skills of pupils in X-XI grades.

Note that in the educational institutions where the experiment was conducted, the lessons were listened, activity of pupils during teaching process was observed, some comparisons were made, a dozens of written and oral works were performed. Analysis of research works with pupils, the results of performed exercises showed that a great majority of pupils could not use a computer at an appropriate level, had difficulties in rapid performance of mathematical calculations, in graphic description of results in the lesson when solving mathematical problems. In the above listed schools a survey with mathematics teachers was conducted. As a result of survey it was determined that in the teaching process the teachers try to use new teaching technologies (euristic, interactive, etc.) but the a great majority of pupils meet difficulties, they can not apply the obtained knowledges to the solution of concrete exercises, when using a computer they can not rightly use technical tools. During the implemented experiment in the program mastering process, at the same time the deficiencies in practical knowledges and abilities, the encountered difficulties were again specified, some appropriate changes and corrections were made in the content of education (in the

system of elaborated exercises) and in the selection, of teaching methods.

Stage 1 of the pedagogical experiment included the problems in the following content directed to deep mastering of education material in X-XI grades.

- 1) Exercises on construction of geometrical figures, especially space figures for X-XI grades.
- 2) According to mathematics plan of X-XI grades, appropriate geometrical problems related to geometrical figures (to proof and calculation).
- 3) Tasks on coordination of features of geometrical figures in mutual form and on geometrical axioms.

The main factors to be taken into account when conducting the experiment are psychological factors. Thus, in teaching geometrical material it is very necessary to determine logical and physiological aspects.

These elements manifest them selves in two forms and they are the followings:

- Logical aspect: in problem solution, in what level to explain ICT in the solution process, in judgment, proof or solution process.
- Psychological aspect. This factor shows itself in internal activity, of psychological state of a pupil. Teacher should feel all reveal this factor. It is necessary to direct pupils psychological state to correct understanding. Because, the level of mastering material the learned lesson is in mutual relation with his psychological state. Thus, determination of pupil's "investigative" side increase of his imagination power is conditioned with development of feeling perception and his factor is directly "revealed" by a teacher.

The knowledge level of pupils (percent of mastering of answers given to the solution of tasks and exercises) was calculated by the following formula and was generalized in the tables given in the dissertation work

$$M_1 = \frac{\sum X}{N_1} 100; \quad M_2 = \frac{\sum X}{N_2} 100$$

Here: M_1 and M_2 is knowledge level of pupils $\sum X$ is the sum of pupils with correct answers; N_1 and N_2 is the amount of pupils.

To determine efficiency of our technigue we get the following formula:

$$U_{ef} = \frac{P(+)}{N} \cdot 100\%, \quad U_{ef} - P(+) = P(-)$$

Here: U_{ef} . is an efficiency index;

$P(+)$ are correct answers;

$P(-)$ are incorrect answers;

N is the amount of pupils.

The results of experiments were given in Table 1 and 2. The results of excises performed by the pupils were expressed in percents.

Table 1.

| Schools | Classes | The amount of pupils | Marks | | | | Mastering difference (in %) |
|---|---------|----------------------|-------|-----|-----|-----|-----------------------------|
| | | | "5" | "4" | "3" | "2" | |
| Baku schools: N: 109, 158 and 254 | K | 186 | 17 | 59 | 60 | 50 | 73,1 |
| | E | 187 | 29 | 80 | 51 | 27 | 85,6 |
| Ismayilli region schools: № 3 and 5 Tezekend complete secondary school named after M.Azimov | K | 184 | 15 | 53 | 65 | 51 | 72,3 |
| | E | 183 | 21 | 81 | 55 | 26 | 85,8 |
| Ganja schools: 2,3 and 31 № | K | 185 | 13 | 50 | 67 | 55 | 70,3 |
| | E | 185 | 22 | 76 | 56 | 31 | 83,2 |
| On average | K | 185 | 15 | 54 | 64 | 52 | 71,9 |
| | E | 185 | 24 | 79 | 54 | 28 | 84,9 |

Analysis of experiments shows that in comparison to control classes, the number of pupils with "excellent" marks in experimantal classes increased for 9 pupils, the puipls with "good" marks by 25 pupils, the number of pupils with "sufficient" marks decreased for 10 pupils.

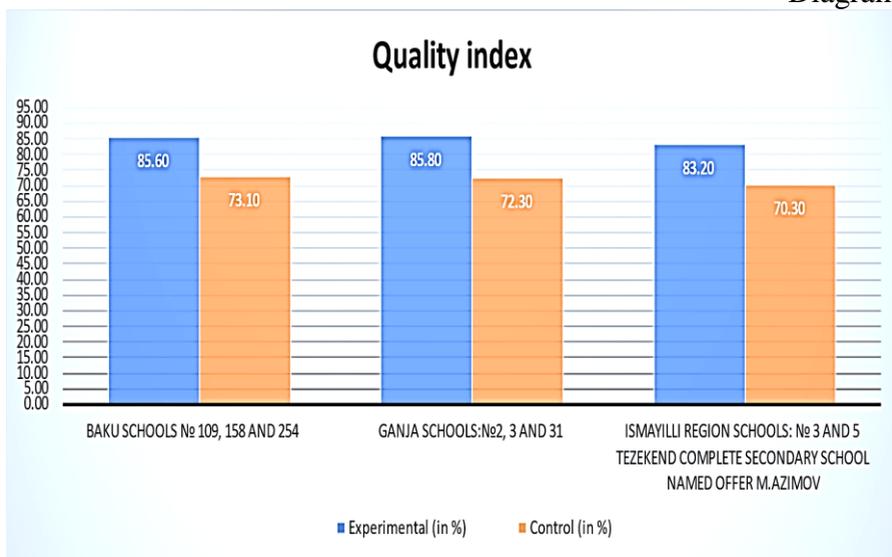
Table 2.

| Schools | Quality index | | Mastering difference (in %) |
|---|---------------------|----------------|-----------------------------|
| | Experimental (in %) | Control (in %) | |
| Baku schools № 109, 158 and 254 | 85,6 | 73,1 | 12,5 |
| Ganja schools:№2, 3 and 31 | 85,8 | 72,3 | 13,5 |
| Ismayilli region schools: № 3 and 5 Tezekend complete secondary school named after M.Azimov | 83,2 | 70,3 | 12,9 |

Thus, comparing the knowledge level of experimental class pupils and control class pupils it was clear that in experimental classes the mastering level of pupils was 12,97% higher than control class pupils. It is relatively a better result.

Analysis of the results of experiments shows that knowledge level of teachers teaching in X-XI classes, the preferred method and technological equipments, the forms and means selected for teaching elements for using ICT in teaching geometric materials had great efficiency. The following figure shows a different variant.

Diagram



When comparing the indicators of experimental and control classes, we obviously see that when pupils use generalizing and developing exercises their

- mathematical, logical, thinking abilities develop,
- space imagination extends,
- abilities of the use of ICT widens
- mathematical outlook expands
- abilities for using technologies during problem solution develop
- they have a great interest to solving nonstandard problems
- form features to transfer the solution of the problem (solution ways) to the opposite side by using the technology
- successively participate at mathematical Olympiads (especially at international Olympiads).

In general, during experiment it was observed that execution of exercises for regular deepening and improvement of learned knowledges increases the level of mastering knowledge, skill and habits and at the same time promotes intensive progress of general development of X-XI grade pupils.

Observations show that though pupils meet certain difficulties in using technological equipment, but they quickly learn to use other media means in order to create interaction, to retain information, to show various types of audiovisual entrance. From the conducted theoretical and experimental researches we obtained the following results:

Conclusion

1. In X-XI grades of school, the content of geometrical material is very rich and has wide opportunities. Along with strengthening their theoretical knowledges by means of exercises system, the pupils are acquainted with new thoughts. Especially, teaching of new knowledges applying ICT is the main factor for the pupils mastering new information very rapidly and effectively. Generalization of theoretical knowledges in practice and application of developing exercises makes necessary to take into account logical psychological aspects. For teaching themes, it is necessary to prepare program packages in the Azerbaijan language, the programming also must be used. Geometric content line must be separated as an independent discipline because teaching of geometry among the algebraic topic is not efficient.
2. As construction of objects of dynamic models of geometric objects in interactive geometric medium is the main actual problem of teaching of mathematics, the hypothesis we offered justified itself.
3. It was detected that pupils deductive analysis is poor in schools.
4. Difficulties when making transformations on any geometric figure by a technological equipment was revealed at the result of experimental tests.
5. In order to develop pupils creative ability to judge, to develop their mathematical thinking it is very important to pay great attention to the solution of nonstandard problems, especially to the factor when using technological equipment, information is transferred to the opposite side more rapidly and obviously.
6. In solving geometric problem or commenting the theme proper coordination of technology and the solution given to the problem has a positive influence on pupils physiological state.
7. In the process of teaching of methamtical disciplines, including for example in teaching drawing great attention should be paid to certain relations between them. We think generalized tasks are the best means from this point of view.
8. Comparison of pupils knowledge showed that using ICT in teaching of mathematics, by making colorful the form and content it is possible to widen mathematical knowledge of pupils.

9. The most encountered problem in classification of teaching programs for learning geometric content line in X-XI grades is minimal amount of computer knowledges. It was researched that a great part of teaching programs are not in the Azerbaijan language and simply working in subprogram translating the panel language into Azerbaijan language the problem can be resolved.

The main provisions and contents of the dissertation are reflected in the following publications:

1. Агазаде, Ш.М. Организация активного учения учащихся при изучении некоторых тем курса математики основной школы // Молодой ученый, -2014, №7, -с.1-5.
2. Ağazadə, Ş.M. “Həndəsə məzmun xətti” haqqında// Azərbaycanın görkəmli alimi və ictimai xadimi, Dövlət mükafatı laurenti, əməkdar elm xadimi, AMEA-nın müxbir üzvü, prof. Yəhya Cəfər oğlu Məmmədovun anadan olmasının 85 illik yubileyinə həsr olunmuş Beynəlxalq elmi konfrans,-Bakı: Bakı Universiteti Nəşriyyatı, -2015, -s.31-33.
3. Агазаде, Ш.М. Технология и геометрическое построение.// Проблемы и перспективы развития образования, Проблемы перспективы развития образования» VI Международная научная конференция, Молодой учёный. -Пермь, -апрель -2015, -с.282-285.
4. Об изучении в старших классах средней школы «геометрической линии содержания» в поэтапной форме.// Материалы VII международной научно-практической конференции, Московский институт гос. Управления и права, -Москва, -2015, -с.258-261
5. Ağazadə, Ş.M. X-XI sinif həndəsə materiallarının İKT vasitəsi ilə öyrənilməsinin müasir problemləri. // -Bakı: Azərbaycan Respublikasının Təhsil problemləri İnstitutu, Elmi əsərlər, - 2016, № 4, - s.247-253.

6. Ağazadə, Ş.M. X-XI sinif İKT və həndəsə məzmun xətti materiallarından psixopedaqoji xüsusiyyətlərinin ilkin anlayışı.// Doktorantların və Gənc tədqiqatçıların XX respublika elmi konfransı, - Bakı: “Azərbaycan Dövlət Neft və Sənaye Universiteti” Nəşriyyatı, - 24-25 may -2016, II cild, -s.5-6.
7. Ağazadə, Ş.M. XI sinif Həndəsə məzmun xətləli İKT-nin material inkişafı.// Əməkdar elm xadimi, professor Əmir Şəmil oğlu Həbibzadənin anadan olmasının 100-cü il dönümünə həsr olunmuş “Funksional analiz və onun tətbiqləri” adlı respublika elmi konfransı, - Bakı: -2016,- s.11-12.
8. Pələngov, Ə.Q., Ağazadə, Ş.M. X-XI siniflərdə həndəsə məzmun xətti ilə İKT-nin əlaqəsi// Azərbaycanın Ümummilli Lideri Heydər Əliyevin anadan olmasının 93-illik yubileyinə həsr olunmuş “Riyaziyyat və mexanikanın aktual problemləri” adlı Respublika elmi konfransının materialları,-Bakı:- 18-19 may -2016, -s.87-89.
9. Abdullayeva, Q.Z., Ağazadə, Ş.M. Kompüter texnologiyaları və həndəsi məsələlər.// - Bakı : Bakı Qızlar Universiteti, Elmi əsərlər, - 2017, № 3, - s.201-206.
10. Ağazadə, Ş.M. Həndəsənin inkişaf mərhələləri.// -Naxçıvan: Naxçıvan Dövlət İnstitutunun xəbərləri, - 2017, №2, -s.113-117.
11. Ağazadə, Ş.M. İKT-nin təhsildə inkişaf mərhələləri.// -Bakı: Azərbaycan Texniki Universiteti, Elmi əsərlər, - 2017, №2, - s.125-129.
12. ИКТ операции для стереометрических фигур в геометрии 10-11 классов.// Azərbaycanın Ümummilli Lideri Heydər Əliyevin anadan olmasının 94-illik yubileyinə həsr olunmuş “Riyaziyyat və mexanikanın aktual problemləri” adlı Respublika elmi konfransının materialları, - Bakı: - 17-18 may, -2017, -s.211-212.
13. Pələngov, Ə.Q., Ağazadə, Ş.M. 10-11-ci siniflərdə 3D-tipli həndəsi fiqurların vizuallaşdırılması/ AMEA-nın tanınmış alim və görkəmli riyaziyyatçı, fizika-riyaziyyat elmləri doktoru, professor Qoşqar Teymur oğlu Əhmədovun anadan olmasının 100 illik yubileyinə həsr olunmuş “Riyaziyyat və Mexanikanın aktual problemləri” adlı respublika elmi konfransının materialları, -Bakı: -2-3 noyabr -2017, -s.90-91.

14. Агазаде, Ш.М. Ресурсы ИКТ в обучении геометрии в 10–11 классах.// -Москва: Вестник Московского государственного областного университета, серия педагогика, -2017, № 2, -с.228-236.
15. Pələngov, Ə.Q., Ağazadə, Ş.M. Yuxarı siniflərdə Həndəsə məzmun xəttinin öyrədilməsi mexanizmi.// Azərbaycanın Ümummilli Lideri Heydər Əliyevin anadan olmasının 95-ci ildönümünə həsr olunmuş “Riyaziyyat və mexanikanın aktual problemləri” adlı Respublika elmi konfransının materialları,-Bakı:- 17-18 may, -2018, -s.79-80.
16. Агазаде, Ш.М. Системный ход механизмов обучения в курсе геометрии (X-XI классы). //-Калининград: Известия Балтийской Государственной Академии рыбопромыслового флота: психолого-педагогические науки, -2018, № 1 (43), -с.154-158.
17. Palangov, A., Aghazada, Sh. The state of the technology in 3D geometry teaching. //“Modern problems of innovative technologies in oil and gas production and applied mathematics” proceedings of the international conference dedicated to the 90th anniversary of Academician Azad Khalil oglu Mirzajanzade,- Baku: -2018, -p.619-623.
18. Yusifova, S., Aghazada, Sh. What is a reusable learning object.// “Modern problems of innovative technologies in oil and gas production and applied mathematics” proceedings of the international conference dedicated to the 90th anniversary of Academician Azad Khalil oglu Mirzajanzade, -Bakı: -2018,-s.356-359.

The defense of the dissertation will be held on 24 september 2021 at 14:00 at the meeting of the Dissertation Council FD 2.15 of the Supreme Attestation Commission under the President of the Republic of Azerbaijan operating at Azerbaijan State Pedagogical University.

Address: Uzeyir Hajibeyli 68, Baku, AZ1000

The dissertation is accessible at the the Library and Information of the Azerbaijan State Pedagogical University.

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

The abstract was sent to the necessary addresses on August 20th., 2021.

Signed for print: 20.08.2021
Paper format: 60x84 1/16
Volume: 33094
Number of hard copies: 20