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DEVELOPMENT OF GEOMETRIC COMPETENCIES AMONG STUDENTS IN SECONDARY SCHOOLS

Tursunov Ikromjon Gulomjonovich
Chirchik State Pedagogical University
Doctor of Physical and Mathematical Sciences, Professor

Narimbetova Zakhia Akhmedovna
Chirchik State Pedagogical University
Doctor of Philosophy (PhD) of Pedagogical Sciences, Acting Associate Professor

Abstract: the paper presents the development of scientific and methodological recommendations for the development of geometric competencies of high school students of secondary schools by means of information and communication technologies.

Keywords: integration, technology, STEAM, mathematical and statistical analysis, innovative technologies, didactic model.

РАЗВИТИЕ ГЕОМЕТРИЧЕСКИХ КОМПЕТЕНЦИЙ У УЧАЩИХСЯ В ОБЩЕОБРАЗОВАТЕЛЬНЫХ ШКОЛАХ

Турсунов Икромжон Гуламжонович
Чирчикский государственный педагогический университет, доктор физико-математических наук, профессор

Наримбетова Захия Ахмедовна
Чирчикский государственный педагогический университет, доктор философии (PhD) педагогических наук, и.о. доцента

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Аннотация: ***в работе представлена разработка научно-методических рекомендаций по развитию геометрических компетенций старшеклассников общеобразовательных школ средствами информационно-коммуникационных технологий.***

Ключевые слова: интеграция, технология, STEAM, математико-статистический анализ, инновационные технологии, дидактическая модель.

Improving the methods of teaching exact sciences in the education system of countries around the world and leading scientific centers, teaching subjects related to geometry with practice, in order to improve the quality of education, scientific research is being conducted on the development of mathematical, geometric abilities and skills of students through the integration of the capabilities of educational technology and educational technology, widespread use of practice-oriented methods, forms and tools.

Based on the introduction of the international STEAM educational program and assessment standards into the general secondary education system of our country, the tasks of preparing students for independent life are being solved through the harmonious teaching of natural sciences, technology, engineering, art and mathematics, the development of systematic analysis and logical thinking skills is being determined. In this regard, it is important to develop the mathematical and geometric competencies of schoolchildren at the stage of general secondary education by improving technologies for teaching mathematical subjects. In the “Strategy of New Uzbekistan” of the Republic of Uzbekistan for 2022-2026, in-depth teaching of mathematics subjects in the general secondary education system, special attention was paid to the implementation of the task of creating an innovative economy in the country through the development of mathematical and geometric abilities of youth.

In the studies of scientists and teachers of our country, such as A. Abdukadirov, M.A. Allaberganova, M. Aripov, U. Begimkulov, I. Taylakov, R.H.

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Zhuraev, F.I. Zakirova, M.H. Lutfillaev, N A.A.Muslimov, G.S.Ergasheva, Z.H.Yuldashev, B.S.Abdullaeva, A.A.Akmalov, I.T.Aliev, G.R.Alimatova, S.Alikhanov, Z.A.Artikbaeva , M.Barakaev, S.Divanova, K.S.Zhumaniyozov, I.U.Ibragimov, F.M.Kasimov, M.A.Mirzaakhmedov N.M.Mukhitdinova, A.A.Rakhimkoriev, M.M.Sultonov, M. Tozhiev, M. I. Toshpulatova, M. N. Tsoi, D. I. Yunusova, Sh. Hamdamov studied the problems of theory and methodology for introducing information and communication technologies into education, methods of using Internet technologies in the educational process, problems of using distance learning technologies, some aspects of the formation of mathematical and geometric competencies of students in secondary schools.

The organization of the educational process based on a competent approach, the issues of forming subject and basic competencies of students and students on the basis of information, communication and pedagogical technologies were studied by scientists of the Commonwealth of Independent States (CIS) A.A. Andreev, A.V. Khutorsky, I.V. Kuznetsova, O.E. Belova, A. Bryleva, N.A. Goncharova, Y.P. Gospodarik, V.V. Gura, A.V. Danilkevich, Z.N. Ismailova, V.A. Kuklev, E S. Matosov, A. L. Nazarenko, O. A. Tarabrin, A. Yu. Uvarov, E. P. Chernyaeva, A. Chirsov, E. V. Yakushina, E. V. Abramov, N. V. Akamova , Zh.I. Zaitseva, L.N. Lavrikova, L.P. Martirosyan, A.V. Mukhamedshina, V.I. Snegurova and L.F. Solovyov.

The effective use of Web 2.0 and other social networks in the education system, issues of improving distance educational technologies in foreign countries were studied and considered by such researchers as B. Alexander, P. Andersen, X. Barret, A. Sampbell, S. Dowhes, M. Notari , T.Richordson, J.Tomcon.

At the same time, it can be noted that the possibilities of developing geometric competencies of secondary school students on the basis of information and communication technologies have not been sufficiently studied.

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The research involves a comparative critical study and analysis of psychological, pedagogical, methodological literature on the problem, the study of advanced pedagogical experience in educational institutions, sociometric methods (questionnaires, interviews, conversations), pedagogical experiment, mathematical and statistical analysis, use of results, as well as observation, comparison and techniques such as generalization.

One of the tasks of school education in conditions of increasingly rapid development is the adaptation of students to life in the world of high technology and information. When solving this problem, it is important to develop geometric competencies in students based on information and communication technologies. The practice of the educational system, analysis of foreign studies and scientific works show that students who have theoretical knowledge experience serious difficulties in applying this knowledge in real situations. Despite the fact that the state educational standard for general secondary education emphasizes the need for students to develop knowledge, skills, and abilities to apply methods of activity in practical situations and everyday life, the level of training of graduates in geometry practically does not meet these requirements. One of the urgent tasks of pedagogical science is the development of special methods for developing competencies related to this subject, including recommendatory means of ensuring the effectiveness of this process.

Since core competencies are formed as a result of the conscious activity of the subject, they cover all basic modes of activity and allow him to use these competencies in accordance with the situation.

Therefore, they are universal and can be formed within the framework of any academic subject, at all stages of the educational process at school.

As a result of the analysis of scientific and pedagogical literature, the structure of basic competencies in the process of developing geometric competencies among high school students of secondary schools was determined.

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Based on the scientific works of I.S. Musatayeva, the composition of geometric competencies that should be formed in a secondary school has been determined: geometric literacy includes knowledge, skills and abilities to identify geometric figures and their properties, carry out constructions, calculate the perimeters and areas of figures, analyze the location of figures in relation to each other, use geometric methods; personal attitude towards geometry is characterized by awareness, geometric knowledge, skills and motivation in their application; methods of activity (recognition of figures in various configurations, the ability to see situations related to spatial and flat geometric figures and relationships, successful independent learning), application of the geometry course in various areas and effective use in life situations.

It is concluded that in the process of developing geometric competencies of secondary school students, it is advisable to pay special attention to the following: the choice of simple, convenient and effective methods in the process of teaching geometry; improving students' geometric competencies based on the capabilities of information and communication technologies; identification and training of talented youth in science; training of talented and qualified specialists in this field.

In the process of teaching “Geometry” in grades 10-11 of a general education school, when choosing effective methods for developing geometric competence, you need to pay attention to the following: identifying topics in the natural sciences, taking into account the intellectual capabilities and level of knowledge of students in grades 10-11; follow as much as possible from the simplest to the most complex when conducting a lesson on topics; abandon the methods used that do not produce practical results; taking into account student relationships when organizing lessons and achieving its effectiveness.

Information and communication teaching aids consist of modern technical capabilities, such as television, radio, mobile communications, and computers. In the course of our research, based on these modern technical means, innovative technologies and methods for developing students’ geometric

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competencies were developed and put into practice. As a result, information and communication tools provided the following opportunities for the development of geometric competencies of students in grades 10-11 of secondary schools: conducting a lesson using information and communication techniques; solve problems on given topics in various ways using technical means; providing additional tasks and recommendations for solving them on each topic; targeted interest, desire and ability of students in the subject "Geometry"; improvement of educational materials related to the development of geometric competence of students in grades 10-11.

Using pedagogical literature, recommendations for distance learning presented in scientific research, and the capabilities of information and communication technology. The essence of this technology is as follows (Figure 2):

Technology for the development of geometric competence of students in grades 10-11 of secondary schools using information and communication technologies of distance learning.

This technology is created on the basis of a special computer program, each folder of which contains relevant materials. File 1 contains the materials analyzed in the first paragraph of the first chapter of our research, file 2 contains the materials of the second paragraph of the first chapter of our dissertation, file 3 contains the methodology for using the development presented above; the 4th file contains the materials of the "Geometry" course of the current mathematics textbook for the 10th grade, the 5th file contains the materials of the "Geometry" section of the current mathematics textbook for the 11th grade. As a result, the use of this technological development has become easier. At the moment, there are opportunities to use this technology both in the traditional educational process and in the form of distance learning. The mechanism for introducing this technology is as follows: 1) in grades 10-11, a geometry curriculum is included; 2) for each topic, textbook materials are provided and enrich them with additional educational materials; 3) the content of educational materials provided for mastering subjects is

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aimed at developing students' independent work and thinking skills; 4) the teacher's book for each topic and training includes recommendations, materials and information that the teacher can use in the process of preparing for training; 5) multimedia educational products on topics are also provided, and there are opportunities to use this information to complete subject classes in different versions; 6) the use of this technology is carried out by the teacher and the student, relying only on a computer information and communication tool. One of the main objectives of our research is to model the process of formation of geometric competencies of students in the process of teaching "Geometry".

Over the next two years, the education system of our country is paying special attention to the electronic-modular education system. Because, firstly, the electronic modular learning system is very convenient for distance learning in specific subjects, such as "Geometry"; secondly, this system allows you to implement the learning process at the required level in modern complex conditions. In our opinion, it is advisable to use an electronic-modular didactic model in the development of geometric competencies of students in the process of teaching the subject geometry developed by Professor Mardanov Sh.K.

Information and communication electronic-modular didactic model for the development of geometric competencies of secondary school students.

The mechanism for implementing this didactic model is as follows: the development is placed in a computer program and all educational materials are reflected in it; it is recommended to use development during the lesson in the form of traditional or distance learning using a computer; the educational materials "Geometry" included in the development for grades 10-11 are enriched with additional information, tasks and recommendations; it is recommended to rely on the activity of students in using the development; The educational process of students is assessed by their creative mastery of topics; Student learning is assessed and monitored by the teacher.

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The information and communication electronic-modular didactic model for the development of geometric competencies of students when teaching "Geometry" in secondary schools has scientific and methodological significance due to its modernity, quick action and convenience.

Regarding the effectiveness of the development of geometric competence of students, experiments were carried out in grades 10-11 of secondary schools No. 8 and No. 15 of the city of Chirchik, Tashkent region, secondary schools No. 17 and No. 70 of the Khatyrchi district of Navoi region and No. 10 and No. 16 of the city of Jizzakh, Jizzakh region.

First of all, a program of experimental work was developed. This program consists of: experimental testing of the methodological foundations for the development of geometric competence of secondary school students; clarification of pedagogical factors and conditions for the development of geometric competence of secondary school students; determining the need to improve methods of teaching geometry in secondary schools; testing of developed technologies based on information and communication means for developing geometric competence of secondary school students; experiment-testing of information and communication technology of distance learning for the development of geometric competence of secondary school students; introduction of an information and communication electronic modular didactic model for the development of geometric competence of secondary school students and determination of its effectiveness; analysis of experimental results.

Based on this program, experimental work was carried out on 312 students in grades 10-11 of secondary schools No. 8 and 15 in the city of Chirchik, Tashkent region, secondary schools No. 17 and 70 in the Khatyrchi district of Navoi region and secondary schools No. 10 and 16 in the city of Jizzakh, Jizzakh region. We present the results obtained at the beginning of the experiment in the table below (Table-1).

Results obtained at the beginning of the experimental work

Prepared diagram of the final result of the experimental test (Figure-3).

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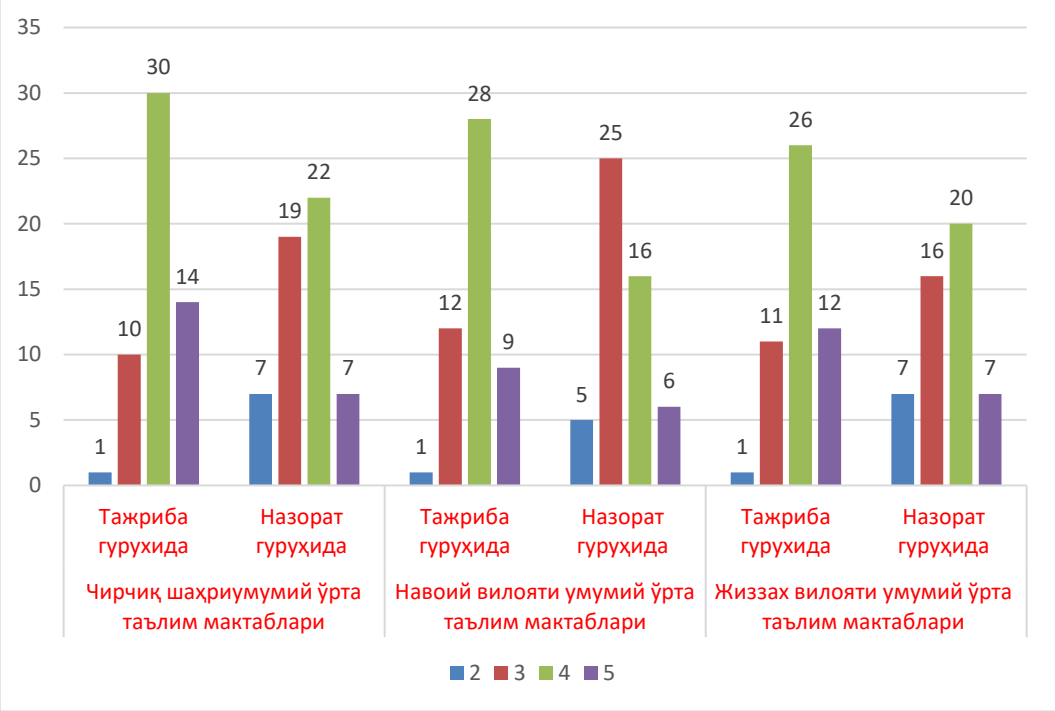

Figure-3. Diagram of the final results of the experiment.

As a result of the implementation of the educational and practical model in the conducted pedagogical testing experiment, the indicator of the effectiveness of student learning increased on average in secondary schools No. 8 and 15 of the city of Chirchik by 14%, in secondary schools No. 17 and 70 of the Khatyrchi district of Navoi region by 13%, and in secondary schools schools No. 10 and 16 of the city of Jizzakh, Jizzakh region by 13%. Efficiency increased by an average of 13.3%. This indicates the effectiveness of experimental work and research.

CONCLUSION

1. Information technologies have great potential for developing students' geometric competencies. Interactive information technology tools make it possible not only to improve visibility, provide students with information in an easy-to-read form (hypertext, multimedia), and perform a control function, but also to solve didactic tasks in the formation and development of competencies. A positive effect is achieved by organizing students' independent work in geometry, joint repetition, their control and evaluation.

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2. An important task is considered to be the in-depth teaching of subjects belonging to the category “Mathematics” in secondary schools, and the formation of knowledge, skills and abilities of students in these subjects at the level of demand. In this regard, one of the pressing problems is to improve the process of developing geometric competencies of students in grades 10-11.

3. The possibilities of distance learning and electronic-modular information and communication technologies in the development of geometric competencies in a secondary school include didactic tasks performed on the basis of virtual laboratory tools, the formation of geometric competencies of students (motivational, cognitive, activity-based, practical).

4. The model for the development of geometric competencies of high school students in secondary schools has been improved using information and communication technologies based on the use of various forms of information presentation in the educational process, complex modeling of practical geometric problems, and the introduction of self-assessment technologies and mutual assessment of students.

5. Mechanisms for using information and communication distance and electronic modular technologies in the process of developing geometric competencies of students in secondary schools, creating and implementing educational projects in the process of organizing students’ educational activities, methods for determining their individual abilities, means of forming universal educational actions, cognitive improvement using various methods.

6. In the process of teaching the subject “Geometry” in secondary schools, the need arose to develop the geometric competence of students, to choose easy, convenient and effective means of teaching the subject, to improve the process of teaching the subject based on the possibility of information and communication means, to identify and train talented youth in the subject, and carrying out such selection. The preparation of talented and qualified teaching specialists in the subject is determined through events.

7. An information and communication distance technology has been developed for the development of geometric competence of students in

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secondary schools; this technology, based on computer programs, provides the basis for teaching this subject in difficult social conditions on the basis of distance learning in grades 10-11.

8. A modern information and communication electronic-modular didactic model for the development of geometric competencies of secondary school students has been formed and mechanisms for its use in grades 10-11 have been created. Didactic support for developments based on the developed information and communication tools has been formed and mechanisms for their use are presented.

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