

Development Of Geometric Creativity Of Secondary School Students By Computer

Kuralov Yuldash Abdullaevich

Abstract : The search for ways to develop geometric creativity of students in the study of mathematics in secondary schools is traditionally carried out by researchers in the direction of the external activity of children in the lesson, characterized by the measure of their involvement in the implementation of educational tasks and related to the form of organization of educational classes, and in the direction of internal activity, characterized by the level of heuristic creativity and related to the implementation of creative tasks, resolution of problem situations. Without reducing the significance of each of these approaches individually, we note that both of them in a real educational process should be harmoniously synthesized. Moreover, an analysis of the features of the multifaceted process of creativity shows that a comprehensive development of all components of geometric creativity that characterize its essence is necessary. The hypothesis of the study is as follows: if you characterize the specifics of geometric activity, determine the component composition of geometric creativity and develop methodological support for the development of each of the selected components using constructive-dynamic, visualization, animation and other computer capabilities, this will allow you to purposefully develop the creative abilities of general education school's students when studying geometric material. The methods, means and forms of the development of geometric creativity of schoolchildren are determined in the article, conclusions are developed.

Keywords: creative technologies, special tasks, geometric problems, problematic teaching, creative thinking in geometry, animation, computer technology.

1 INTRODUCTION

Modern society cannot function effectively without finding new ways of developing the creative activity of people in all spheres of life. Its improvement involves the education and training of highly educated people who are prone to creative activity in various fields of science, culture and technology. In conditions of accelerating scientific, technical and social progress, the formation of a creative personality is one of the strategic goals of modern pedagogy and school. The most important is the task of developing the intellectual abilities of children, the ability to think, creatively solve problems that arise in the process of life. Simply assimilating the totality of knowledge by children is no longer enough; there is a need for the young generation to form a need for independent creative activity and to develop their mental abilities.

2. MATERIALS AND METHODS

The object of research is the process of geometric education of students of secondary schools. The subject of the study is a methodological system for the development of geometric creativity of students in secondary schools using information technology training. The purpose of the study is to develop methodological foundations for the development of geometric creativity of students of secondary schools by means of information technology training. Studies of the ways of developing geometric creativity of students in the study of mathematics in secondary schools are traditionally conducted by researchers in the direction of the external activity of children in the lesson, characterized by the measure of their involvement in the implementation of educational tasks and related to the form of organization of educational classes, and in the direction of internal activity, characterized by the level of heuristic creativity and related to the implementation of creative tasks, resolution of problem situations.

Without reducing the significance of each of these approaches individually, we note that both of them in a real educational process should be harmoniously synthesized. Moreover, an analysis of the features of the multifaceted process of creativity shows that a comprehensive development of all components of geometric creativity that characterize its essence is necessary. The hypothesis of the study is as follows: if you characterize the specifics of geometric activity, determine the component composition of geometric creativity and develop methodological support for the development of each of the selected components using constructive-dynamic, visualization, animation and other computer capabilities, this will allow you to purposefully develop the creative abilities of general education students schools when studying geometric material. To achieve this goal and test the hypothesis formulated, it was necessary to solve the following main tasks:

- based on the analysis of psychological, pedagogical and methodological literature on the research problem, characterize the essence of geometric creativity and disclose approaches to the development of creative abilities of students of secondary schools in teaching geometry;
- highlight the structural components of geometric creativity;
- build a model for the development of geometric creativity of students;
- develop methodological foundations for the development of each of the identified components of geometric creativity in the study of geometric material using information technology training;
- experimentally verify the effectiveness of the proposed methodological tools in the practice of training. Methodological foundations of the study:
- The concept of an active approach to the development of students' creative abilities in teaching geometry; the concept of a focused approach to the development of students' creative abilities in teaching geometry;
- psychological research on the problem of creativity (I. Torrens, J. Gilford, Ya.A. Ponomarev and others);
- research on the theory of teaching geometry in secondary schools. To solve the tasks, the following methods of pedagogical research were used: analysis of philosophical, psychological, pedagogical and methodical literature on the

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- research problem;
- the study of domestic and foreign experience in the development of creativity of students in mathematics; analysis of educational standards and curricula in geometry for a comprehensive school;
- system analysis of pedagogical objects;
- generalization of the existing experience of teachers in developing the creativity of students in secondary schools in teaching geometric material;
- experimental verification of the main provisions of the dissertation research using the developed teaching materials in a real educational process;
- statistical processing of data obtained during the experiment.

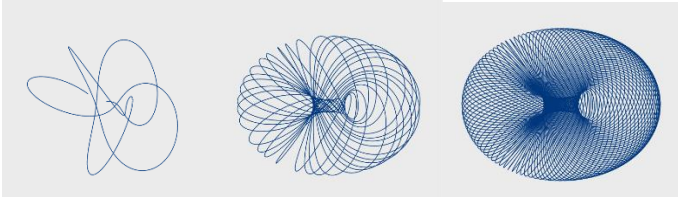
Literature Review. The need in modern conditions to rethink approaches to the development of creativity in the education system puts the focus of researchers on the problem of creativity and creativity. The problem of abilities, creativity and creative activity, the application of information technology in education was studied by many psychologists: B.G. Ananyev [2], V.L. Andreev [3], A.K. Artemev [4] V.V. Davydov [9], V.N. Druzhinin [11], V.A. Izvozchikov [12], Disterveg [10], Torrance [35], [36], C. Taulor [33], R. Sternberg [38], S.L. Rubinshteyn [27], N.F. Talyzina [29], E. Ogurcova [23], K.K. Platonov [25], Ja.A. Ponomarjov [26], M.N. Skatkin [28], O.V. Fyodrova [30], E.I. Mashbic [20] M.I. Mahmutov [19], E.V. Kuznecova [16], V.A. Kruteckij [15] and others. Scientists do not hold a single view on the concept of creative activity. Some stop at getting a certain C.JI product. Rubinstein and others), others focus on the procedural side of the matter (I.Ya. Lerner [17], P.I. Pidkasisty [24], etc.) Of particular relevance is the development of creative abilities and the formation of creative activity when learning geometry. The possibilities for the development of creative abilities and various aspects of the formation of creative activity during the training of geometry are reflected in the scientific and methodological works of many educators and mathematicians: S. Alikhonov [1], G.D. Glaser [6], A.Ya. Tsukar [32], V.A. Gusev [7], [8], M.V. Egupov [14], I.S. Bekesheva [5], S.V. Maslova [18], A.K. Nasybulina [22], D.M. Makhmudova [21], A. Khamrakulov [31] and others. Theory and Discussion. The development of geometric creativity of students of secondary schools by means of information technology is due to several reasons. Firstly, a distinctive feature of the current stage of development of society is the rapid penetration of information technology in all areas of public life, which necessitates the assessment of existing approaches to learning, as well as the development of new ones. In this regard, the creation of a promising educational system that can prepare the world's population for life in the information society is one of the most important and urgent problems for the education sector. Secondly, at present, special attention is given in the secondary school to the developmental goals of instruction. Mathematics, like no other science, has great potential for the intellectual development of students. With the advent of computer technology, these capabilities have been further enhanced. So, it became possible to visualize the various stages of the geometric activity of students, to use the functions of a computer to develop spatial imagination, logical thinking, children's observation, flexibility and criticality of the mind. There was a need for a special study of the possibility of a purposeful and systematic use of information technology in order to develop in the process of teaching geometry the intellectual abilities of

students and, in particular, their component - creativity. Thus, the formation of creative activity in the learning process is the most important task of the modern school, which is closely related to the disclosure of the potential opportunities and abilities of each student, therefore, the problem of developing students' creative abilities always attracts the attention of both researchers and educational practitioners. The problem of the targeted development of geometric creativity of students is very complex and multifaceted. This is due to the fact that creative activity is interconnected with many aspects of the educational process. It acts simultaneously as a goal in terms of personality formation, as a result of a certain way of organizing educational activities of students, and as a means of increasing the effectiveness of the learning process. Thirdly, the analysis of the conducted research allows us to state that the problem of the development of creativity and the formation of creative activity has not yet been sufficiently solved, although it has been studied quite extensively, in particular, in the theory of teaching geometry. So, in methodological studies, an answer to a number of questions was not found, without which the creative activity of students cannot be successfully formed: the principles of the formation of the creative activity of students of secondary schools in the study of geometric material are not defined, an integrated methodological system for the development of geometric creativity of students of secondary schools is not created, and Also, approaches to the use of information technology training as an important methodological tool were not found. Fourthly, an analysis of the content of the mathematics course in secondary schools showed that there are great opportunities for the formation of creative activity, especially when studying geometric material, which at the moment is clearly not being realized. Given that geometry has at its disposal a huge potential for the development of creativity, and the computer is a powerful methodological tool that allows it to be enhanced by dynamic, graphic, computational and other capabilities, there is a need for targeted systematic work to organize students' creative activities using information technology learning, relying on the development of geometric creativity. This will increase the interest of students in the study of geometric material, which in turn will improve the quality of knowledge in the subject and expand the possibilities of developing computer literacy. As a result, the contradiction between the school's need for new scientifically based methods of using information technology for education for the development of geometric creativity of students in secondary schools and their actual absence today determines the urgency of the problem of dissertation research, which consists in finding ways and means of developing geometric creativity of students in secondary schools by means of information learning technologies. The choice of methods and forms of teaching geometry that contribute to the formation of geometric creativity of students takes place in accordance with the principles of its formation, justified and formulated above: appropriateness, consistency and continuity, component-wise completeness, consciousness and activity. Thus, in the course of performing such tasks, students acquire knowledge about creative methods for solving geometric tasks, as well as about methods for the formation and development of creativity, students using the geometric apparatus. Using GIF animations in class can provide a comprehensive view of shapes. For example, Clayton Shonkwiler GIF animations can help with geometry classes [<https://shonkwiler.org/>]:

Example 1. Create a toric knot.

Questions:

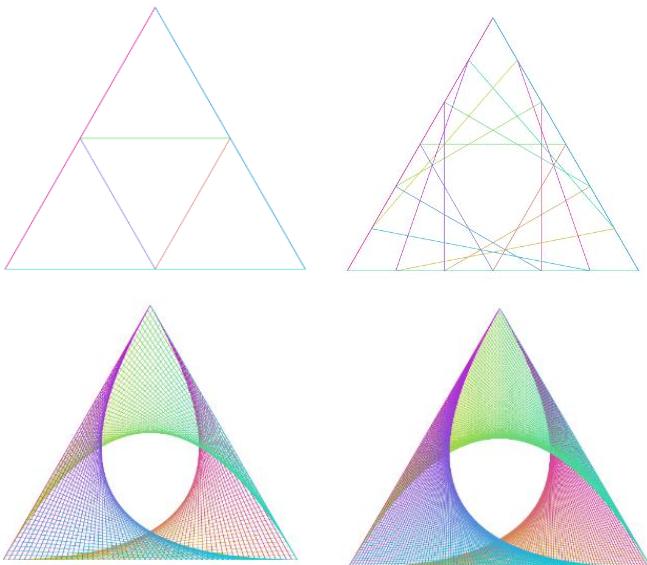
- 1) What is a toric knot?
- 2) How can I draw a knot?
- 3) If we create multiple nodes in one image, how do you get a picture?



Example 2. A triangle is the simplest closed rectilinear figure, one of the first, the properties of which a person recognized in ancient times, since this figure has always been widely used in practical life. For centuries, the property of rigidity of the triangle has been used for centuries to strengthen various buildings and their details. The image of triangles and tasks on triangles are found in papyrus, in ancient Indian books and in other ancient documents. We examined the types of triangles, we know some of their properties, and today we will continue to study the properties of a triangle, regardless of its type.

Questions:

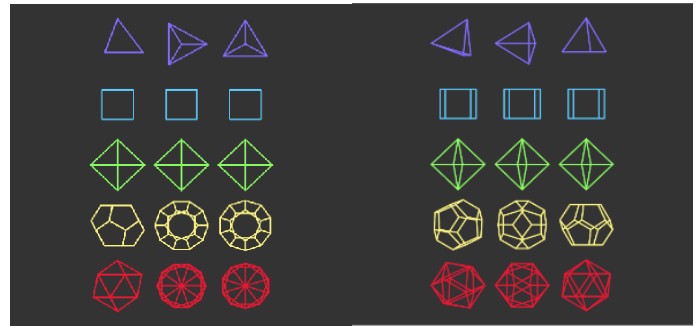
- 1) Remember what shape is called a triangle.
- 2) What can be the triangles depending on the size of the angles?
- 3) How many triangles can be placed in one triangle?
- 4) What do you think, if you fill a triangle with other triangles - what image can be obtained?



Example 3. Regular polyhedra (Platonic solids).

Questions:

- 1) What is a polyhedron?
- 2) How do you represent regular polyhedrons?
- 3) If you draw five regular polyhedra (Platonic solids), in rotation in each of the three dimensions, what will it look like?



Or, we can use Paint during class to paint a lot of geometric shapes.

The methodology for the formation of students' creativity in the process of teaching geometry is effective if it meets the following criteria:

- **target** - reflects the target vector of the formation of students' creativity in the process of learning geometry;
- **informative** - enriches the content of teaching geometry to students with creative-oriented geometric tasks at each stage of the model;
- **organizational and procedural** - it is a set of mutually dependent methods, forms and teaching aids adequate to the goals and content of the training (methods: heuristic methods, case study method, project method, game technologies, etc.; forms: various types of lectures, seminar, business game, independent work of students, etc.; means: teaching aids, methodological recommendations for studying a course at the students' choice, alternative forms of assignments, etc.);
- **diagnostic** - designed taking into account the specifics of the subject and provides reliable information about the dynamics of the level of geometric creativity of students in secondary schools.

1. EXPERIMENTAL RESULTS

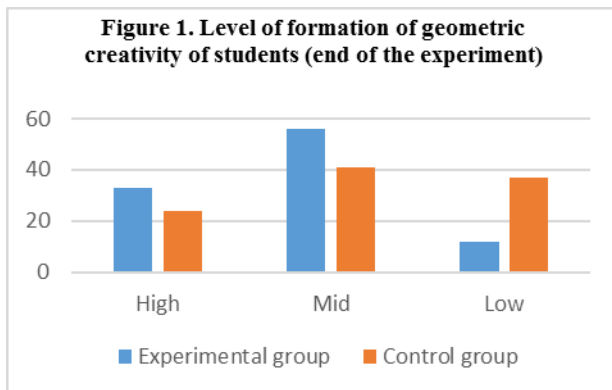
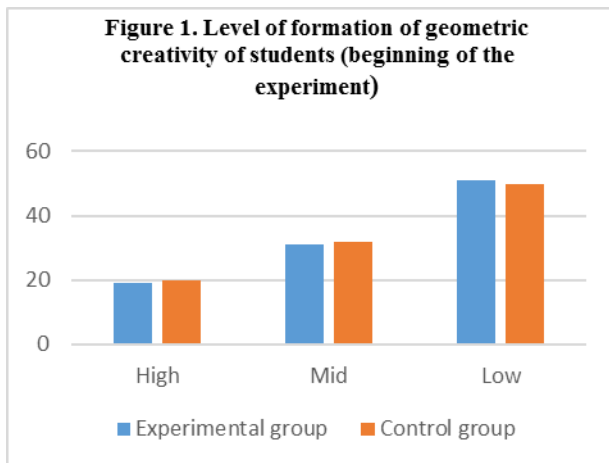
The study was organized as follows:

- at the first stage, scientific, educational, psychological and pedagogical literature on the topic of dissertation research was studied and analyzed, the real state of the practice of the development of geometric creativity of students in secondary schools was analyzed, and a stating experiment was conducted;
- at the second stage, the conceptual provisions for the development of geometric creativity of students of secondary schools using computer-based learning technologies were determined, methodological materials were developed, and their initial testing was carried out;
- at the third stage, a training experiment was conducted, the results of the dissertation research were tested, an abstract and dissertation work were drawn up.

To conduct a component-wise analysis of the level of geometric creativity of students, empirical data were presented in table form.

Table 1. Dynamics of the level of formation of geometric creativity of students at the beginning and at the end of the experiment.

Groups Number of respondents $n=203$	Arithmetic expression	Level indicators					
		At the beginning			In the end		
		High	Mid	Low	High	Mid	Low
Experimen- tal $n_i=101$	X_i	19	31	51	33	56	12
Control $n_j=102$	Y_j	20	32	50	24	41	37



The effectiveness of the developed methodology for the formation of geometric creativity of students in secondary schools has been experimentally confirmed.

4. CONCLUSION

- Of particular importance in the development of geometric creativity of students of secondary schools are creative tasks selected in accordance with the model of geometric creativity, which can simultaneously influence the development of each of the three components of creativity: reproductive-variative, variably productive and creative-creative, that is. with the effect of complex effects.
- The development of the reproductive-variable component of geometric creativity is advisable to carry out by completing tasks to determine the shape, size, location, relationships and transformations of geometric shapes.

- The development of the variably productive component is realized through heuristic variation of geometric situations using dynamic, computational and other capabilities of information technologies.
- The development of a creative-creative component is carried out by completing tasks for creating new geometric images, obtaining unusual geometric configurations, modeling the properties and dependencies of the elements of geometric shapes.
- The conducted pedagogical experiment confirmed the effectiveness of the approach to the development of methodological foundations for the development of geometric creativity of students in secondary schools using the information technology of teaching described in the dissertation. The hypothesis of the study was confirmed.

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