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The Relationship between the Student's Creative Activity and Ability in Interdisciplinary Synchronous-Asynchronous Teaching of Geometry at School

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ABSTRACT

In the article, in the teaching of geometry at school in interdisciplinary synchronous-asynchronous communication, the relationship between the creative activity and ability of the student, the creative process, experimental and non-experimental methods that form the scientific basis of research, methods, the structure and characteristics of mathematical abilities, numbers, numbers , the memory of formulas, the ability to spatial impressions, the ability to model abstract mathematical relationships and connections are discussed.

Creativity in mathematics helps students make sense of the world. However, in our secondary schools, students are taught that mathematics consists only of rules, theorems and processes. Students need to see how mathematics has evolved and understand how creative individuals have shaped the body of mathematical knowledge. For this, more attention should be paid to creative ways of expressing ideas. In today's age of information and communication technologies, there is a need for an activity that arouses students' interest and makes them want to deeply understand and respect their mathematical creativity, and increases the enthusiasm for mathematical creativity.

Mathematics is used for various practical purposes as well as for the inner interests of man, while relying on logic and creative approach. The essence of mathematics lies in its beauty and intellectual function. Getting to know the student's activity and ability to be creative is one of the most important aspects of our life, because everything we do depends on our ability to think.

Creativity. Creativity is a complex concept, which has been studied by scientists such as D. Haylock, E. Mann, B. Siraman, Ye.P. Torrens from different perspectives [2, 6, 9, 12]. It was

determined that the ability to quickly use the information in the tasks depends on the ability. Calling this type of thinking creativity, they began to study it independently of the individual as an idea such as opening or creating something new. It should be noted that currently there is no single authoritative concept and single definition of creativity [6,9 .]The concept of "creativity" has many and is constantly changing.

Based on scientific literature, E. Mann notes that there are more than 100 modern definitions of the concept of "creativity" [6] E. Torrance suggested using a number of tests designed to demonstrate creativity in defining the concept of "creativity" [12].

However, several experts on creativity emphasize that in general, a person goes through the creative process: 1) Preparation stage - acquisition of skills, perception and problem definition; 2) concentration stage - strong focus on the problem; 3) the incubation stage is the way to get rid of the problem; 4) The stage of understanding - the stage of the birth of an idea; 5) Development stage - testing the idea.

This definition is based on interrelated relationships such as lightness, agility, innovation, and complexity.

Lightness - the speed of completing test tasks. This is reflected in the continuity of ideas, the use of general and basic knowledge;

Agility is the number of times one can switch from one solution to another as a result of answering. This is the ability to change ideas, consider problems in different ways, and have many solutions;

Innovation is standing out with a unique new way of thinking. Minimum frequency of response to one type of issue;

Complexity is manifested in the ability to describe, clarify and generalize ideas. The most influential of the four presented components. novelty or originality, as creativity is reflected in original ideas, approaches, or process actions associated with creation (eg, a new work of art or a scientific hypothesis) [12].

To determine the level of creativity, Dj. Gilford identified 16 approximate intellectual abilities that describe creativity.

Of these:

1) Volatility of thought - the number of ideas that arise per unit of time;
2) Agility of thought - the ability to move from one idea to another;
3) Great thinking - the ability to create ideas that are different from the generally accepted views;
4) Curiosity - sensitivity to environmental problems.
5) The ability to develop a hypothesis;
6) Irreality (unreal) - logical independent reaction (change) that does not depend on the stimulus (stimulating factor);
7) Fantasticity (fantasy) is a complete disconnection from reality (authenticity) in the existence of a logical connection between stimulus and reaction.
8) The ability to solve problems, that is, the ability to analyze and synthesize;
9) Ability to perfect the object by adding details and details; and so on;

Creativity is a component of the organizational system that stands above it, and the component that stands behind it serves as a condition for the development of creative abilities. In order to

understand the essence of creative mastery, we use a number of concepts - the apparatus of logical analysis, in its psychological analysis. Such concepts include the categories of goals and tasks, means and results. Achieving efficiency in the interdisciplinary synchronous-asynchronous teaching of geometry at school requires not only the teacher, but also the student's creativity in the problem-solving process. Determining such an approach to educational activities in subjects takes place on the basis of the following conditions. In particular: - To achieve that all subject teachers and students are aware of the theoretical knowledge of the essence and advantages of modern pedagogical technologies;

- to ensure the emergence of the need to organize the implementation of geometry problems in a mathematics teacher based on a new approach; - formation of skills and abilities to use non-traditional forms, methods and tools in the organization of geometry problem-solving classes; - Availability of conditions that allow effective use of information technology services by the teacher of this subject in the teaching of geometry in the interdisciplinary synchronous-asynchronous connection; - Achieving the organization of the teaching of geometry in the school in interdisciplinary synchronous-asynchronous communication based on a certain project; - creation of opportunities for students to independently read and learn topics in the interdisciplinary synchronous-asynchronous teaching of geometry at school; - to regularly study the level of effectiveness of the student's educational and creative activity in the teaching of geometry in the interdisciplinary synchronous-asynchronous relationship at school, to identify existing problems, and to develop measures to eliminate them.

Below, we will focus on the special mathematical creativity of students. It is very difficult, perhaps even impossible, to give a clear and generally accepted definition of mathematical creativity, as in general creativity [2, 5, 6, 9]. E. Mann's research attempts to define mathematical creativity showed that the lack of a definition of general mathematical creativity hinders the definition of special mathematical creativity. [6]. According to modern researchers, it is a complex process to determine the relationship between mathematical creativity and mathematical ability. based on the opinion that it exists and can be developed [3,5, 8, 11, 9, 12]. R. Subbotnik, E. Pilmaer, L. Yarvin believe that creativity is the basis of the work of professional mathematicians. Mathematicians choose and solve practical and complex problems during their work. G. Erwink considers mathematical creativity as one of the characteristics of developed mathematical thinking. He considered mathematical creativity as the ability to formulate mathematical goals and the relationship between them by summarizing with developed mathematical thinking [1]. At the same time, L. Sheffield and E. Silver, when conducting a study called "creativity of all students", believe that setting a problem and finding a solution is the main means of developing creativity in all students [8, 10]

Adhering to the experimental point of view, L. Sheffield proposed to create a continuous sequence of mathematics. Creating mathematical creativity by developing mathematical creative abilities: students who do not understand mathematics → creators → computers → consumers → students who solve problems → master problem solvers → creators [8]. In our opinion, such development depends on the student's mathematical ability and creativity. Our research shows that we develop adaptability in students, not originality. And originality is manifested only in a few people. 1. Problems that can be solved in different ways. Multiple-Solution Problems - Exercise problems require the learner to solve as many ways as possible. If the problem is based on the following, then it is called a problem that can be solved in different ways: a) a mathematical concept used in the problem can be described in different ways; b) through various properties (definitions, theorems) of mathematical objects of a specific field; s) through different properties of mathematical objects in different fields; In teaching geometry at school in the interdisciplinary synchronous-asynchronous connection, the production of the order of experimental problems is formed by the structure of mathematical abilities based on the hypothesis, which consists of 9 components: 1) abilities to generalize mathematical material; 2)

the ability to reduce, reduce the process of considerations, discussions, and think with an expanded structure; 3) the ability to return to the thinking process (switching to direct, reverse thinking); 4) ability to formalize mathematical material; 5) the ability to work with numbers and symbols; 6) the ability to think logically, correctly divided; 7) changeability of thinking, the ability to switch from one mental state to another; 8) the ability to visualize remotely; 9) mathematical memory ability. The experimental and non-experimental methods and methods that form the scientific basis of the research in the teaching of geometry in the interdisciplinary synchronous-asynchronous relationship at school, allowed to make certain conclusions about the structure of mathematical abilities and the characteristics of students' mathematical abilities:

1) in the teaching of geometry in the interdisciplinary synchronous-asynchronous relationship at school, the organization of the specific psyche of students with certain abilities in mathematics was carried out. This is ,understanding the surrounding phenomena according to logical and mathematical categories.' qualitative characteristics of mathematical abilities related to the number of word-logic or clear, fluent figurative components in the students' thinking activity were determined. appearance), harpeonic (two changed forms). 3) As a result of the experiments, the exact structure of the students' mathematical abilities was obtained, which was confirmed by the well-defined names of the components that confirm the hypothesis about the structure of mathematical abilities.

Below we present the scheme of the general structure of school-age mathematical abilities in the teaching of geometry in the interdisciplinary synchronous-asynchronous connection at school: 1) reception of mathematical information in the teaching of geometry in the interdisciplinary synchronous-asynchronous connection at school: the ability to formally receive mathematical material, the formality of the problem to improve the structure 2) information processing in teaching geometry at school in interdisciplinary synchronous-asynchronous connection: a) logical thinking in the conditions of number and space relationship, ability of number and sign symbols; the ability to think with mathematical symbols; b) the ability to quickly and widely generalize mathematical objects, relations and actions; c) the ability to switch to the process of mathematical reasoning and related actions; the ability to think with restructuring; g) variability of thinking in the process of mathematical activity; d) try to solve the conclusion clearly, simply, correctly, rationally; e) quickly and independently change the direction of the thinking process; the ability to switch from correct thinking to the opposite (reversibility of the thinking process in mathematical reasoning); 3) retention of mathematical information in the interdisciplinary synchronous-asynchronous teaching of geometry at school: mathematical memory (generalized memory of mathematical relationships, exemplary description, view of considerations and proofs, principles of problem solving and approach to them) 4) interdisciplinary synchronous geometry in school -general synthetic component in teaching in asynchronous communication: mathematical orientation of mind. The components that are distinguished in the teaching of geometry in the interdisciplinary synchronous-asynchronous relationship at school are integrally related to each other, influence each other, and all together form one method, system, the whole, complete structure of mathematical ability, the mathematical structure of the mind. constitutes Components included in the structure of mathematical abilities: 1) the speed of the thinking process, as well as the description of time; 2) calculation ability; 3) memory for numbers, figures, formulas; 4) ability to spatial impressions; 5) the ability to model abstract mathematical relationships and connections. For the modern educational process, creativity is only an addition to the main curriculum. Therefore, one of the ways to solve this problem is to improve the learning process through interdisciplinary communication using creativity. In this case, we are talking about the use of creative problems prepared by the science teacher. Problems should be structured in such a way that in the process of solving them, students use the processes of analysis, comparison, generalization, relying on images based on the visual-form imagination, which is closely related to imagination. Tasks such as the search for independent learning, the satisfaction of knowledge needs, the expression of creativity, imagination, the expression of

individuality, internal motivation for change, exploration, and the creation of innovation that create interest and purpose are also included. Achieving efficiency in the teaching of geometry in the interdisciplinary synchronous-asynchronous relationship at school requires creativity in the problem-solving process not only on the part of the teacher, but also on the part of the student.

Deciding on such an approach to the student's educational and creative activity takes place on the basis of the following conditions, in particular: - to make the mathematics teacher and the student aware of the theoretical knowledge about the essence and advantages of innovative educational technologies; - Ensuring the emergence of the need to organize geometry in the school based on a new approach to interdisciplinary synchronous-asynchronous communication; - Development of skills and abilities to use non-traditional forms, methods and tools in teaching geometry in interdisciplinary synchronous-asynchronous communication at school; - Creation of conditions that allow the effective use of information technology services by the science teacher in the teaching of geometry in the interdisciplinary synchronous-asynchronous relationship at school; - To achieve the organization of geometry example and problem-solving classes based on a specific project in teaching geometry in interdisciplinary synchronous-asynchronous communication at school; - creating opportunities for students to study subjects independently; - Organization of problem-solving classes in interdisciplinary synchronous-asynchronous teaching of geometry at school, regular analysis of the effectiveness of the development of the student's creative activity, identification of existing problems, development of measures to eliminate them.

The following three teaching methods were used as a basis for the selection of issues in the interdisciplinary synchronous-asynchronous teaching of geometry at school: practical, visual and problem-based, as well as three forms of teaching: individual, pair work, team work. The following principles of teaching were used in the teaching of geometry in the interdisciplinary synchronous-asynchronous connection at the school: 1) positive support of absolutely all thoughts and decisions of students; 2) recognizing their own mistakes and those of their comrades as a possible way to solve the existing problem; 3) lack of restrictions on students' actions and solving problems; 4) do not allow attempts to ban, rudeness, ridicule by students based on the opinion expressed by a classmate; 5) organization of friendly relations between students when working in pairs; 6) creating an environment of mutual trust (teacher - student; student - student); 7) accepting any form of creativity (verbal, graphic, written, illustrative, etc.); 8) to involve each student in the process of solving the problem not necessarily, but voluntarily; 9) Absence of the condition "no solution to the problem - bad grade". Let's consider the following issues as an example. Issue 1. Make 3 questions from the words given below. One is for proof, the second is for calculation, and the third is in the direction you want. Additional words, conjunctions, numerical and literal expressions can be used during the construction of the problem. Words: height, surface, angle, parallelogram, side, triangle, radius, diagonal, sine, cosine. Issue 2. Give several statements connecting (separating) the following words: 1) perpendicularity and parallelism; 2) intersecting and crossing; 3) planimetry and stereometry; 4) point and straight line. Issue 3. Issues that increase creativity are divided into 2 types. 1. Temporary: the style of the lesson is as usual, and the task is given to be completed during the whole lesson. (Students can do this task in between solving the main problems.); on time (usually within 15 minutes); the time is not limited (the problem continues until the students solve it. The student can do the problem in the classroom and at home. In this case, the teacher must tell the student that the condition of the problem must be followed. The only condition for completing the problem is the next new the subject is marked as past tense). 2. Evaluator: the student is evaluated (from the point of view of science); no assessment (only verbal encouragement); it is evaluated when it is given as an additional question in the lesson (depends on the teacher). It is clear from this that the teacher should evaluate the students from the point of view of science, not to determine the level of creativity of the completed problem. Finding a creative solution to a mathematical problem does not mean knowing mathematics. The teacher should teach the student that the more creatively he approaches the problem, the more his

thinking will improve. We will consider two cases below. Case 1. From a mathematical point of view, the student solved the problem with a grade of `2', but in his opinion, he approached the problem creatively. According to the teacher, there is no creativity in the matter. So what to do? Solution to case 1. In our opinion, in this case, it is necessary to engage the student in a conversation, without immediately assigning a grade to him. Be interested in what the creative approach to the problem is, draw his attention to mathematical mistakes and offer to solve the problem with a new creative approach. He tries to solve such problems carefully. The teacher does not give a subjective assessment. Case 2. The student solved the problem from a mathematical point of view with a score of 5 and, in his opinion, approached the problem creatively. According to the teacher, there is no creativity in the matter. So what to do? Solution of case 2. In our opinion, in this case, the teacher should give the student a grade of `5' and engage him in a conversation. It is necessary to be interested in what the creative approach to the issue manifests itself. A student should be praised if he confidently demonstrates creativity with determination. If he himself says that he did not approach creatively, then he should be asked to pay more attention to such issues in the future. Students themselves can subjectively evaluate the manifestation of creativity. For example, it is possible to combine them into groups and propose a task that is the same for everyone. In this case, there is a competition for the best creativity. In our opinion, it is appropriate to conduct group work after completing a system of problems that develop creativity. In this, creativity is evaluated by groups. At the same time, students show positive competition for the best ideas. Such problems can be demonstrated at the beginning of the lesson using an interactive whiteboard or other suitable materials visible to the students. They calm students after a noisy break, attract their attention, and strengthen the use of critical thinking.

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