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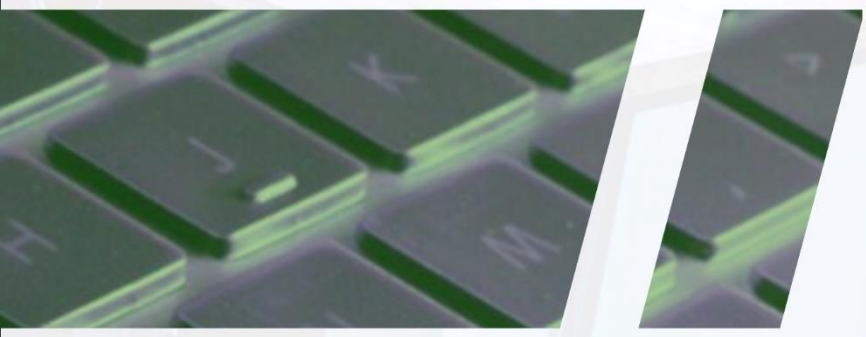

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PEDAGOGICAL AND PSYCHOLOGICAL CONDITIONS OF FORMATION OF GEOMETRIC CONCEPTS

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Annotation. *This article provides information on the pedagogical and psychological conditions for the formation of geometric concepts, the stages of cognitive development and ways of formation of students of junior school age, and the model of understanding geometric concepts in students. Also, based on the classification of David Tall and Shlomo Winner, the important indicators of the development of geometric concepts in students were discussed.*

Key words: *multimedia, mathematics, geometry, skill, competence, sensory perception, practical experience, cognitive skill, sensorimotor, concrete operational, preoperational, abstract operational, visual thinking, construction and imagination, cognitive development, geometric images, social interaction.*

INTRODUCTION.

Based on today's requirements, it is very important and effective to organize lessons for students using new innovative multimedia and computer technologies, especially mathematics lessons. It is no secret that in the rapidly developing age of information technology, it is very difficult to interest students in lessons using simple demonstration tools.

Currently, the modern teaching process is based on the 4K model, where all examples and problems are aimed at students' logical thinking through textbooks, and students are directed to apply these examples and problems in their daily lives. Teachers face some difficulties in conveying these types of examples and problems to students. The role of multimedia technologies and applications in the teacher's work is very important in conveying the given examples and problems to students. For this, the teacher must also have a high level of knowledge of ICT technologies and have the skills to use them in professional activities. After all, the 21st century is the age of information and communication, which requires educators to have abilities such as creativity, organization, and research, and to be competent teachers who have mastered basic competencies.

RESEARCH METHODOLOGY.

In line with current demands, teachers must consistently use modern teaching aids in their lessons to make lessons high-quality, interesting, and to increase students' motivation to learn.

Decree of the President of the Republic of Uzbekistan No. PF-60 dated January 28, 2022 “On the Development Strategy of the New Uzbekistan for 2022-2026”, Decree No. PF-5538 dated September 5, 2018 “On Additional Measures to Improve the Public Education Management System”, Decree No. PF-5712 dated April 29, 2019 “On Approval of the Concept for Developing the Public Education System of the Republic of Uzbekistan until 2030” provide for further development of the activities of general education organizations, measures are indicated to ensure the implementation of tasks aimed at improving the quality of education, stimulating students' interest in knowledge, and further increasing students' mastery indicators.

The formation of geometric concepts in younger school-age students is an important part of the educational process, and this process should be organized on the basis of pedagogical and psychological laws. Teaching younger school-age children requires teaching methods based more on imagination, emotional perception, and practical experience. There are certain pedagogical and psychological conditions for the successful formation of geometric concepts, the main ones of which are described below (Figure 1):

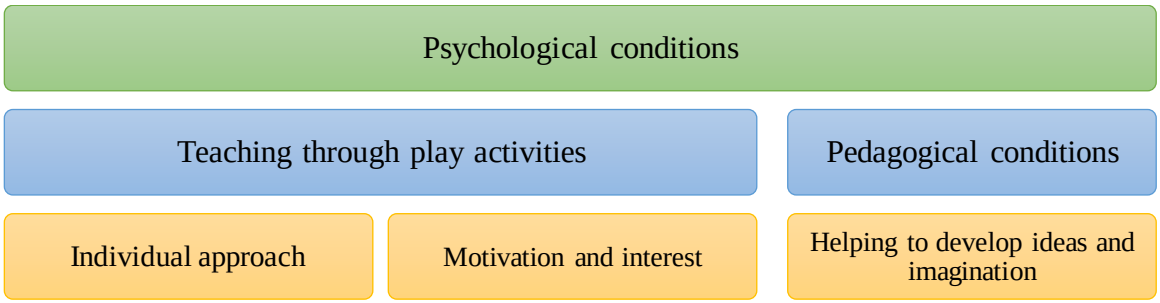

Figure 1. Pedagogical and psychological conditions for the formation of geometric concepts.

Students of primary school age go through different stages of cognitive development (Figure 2):

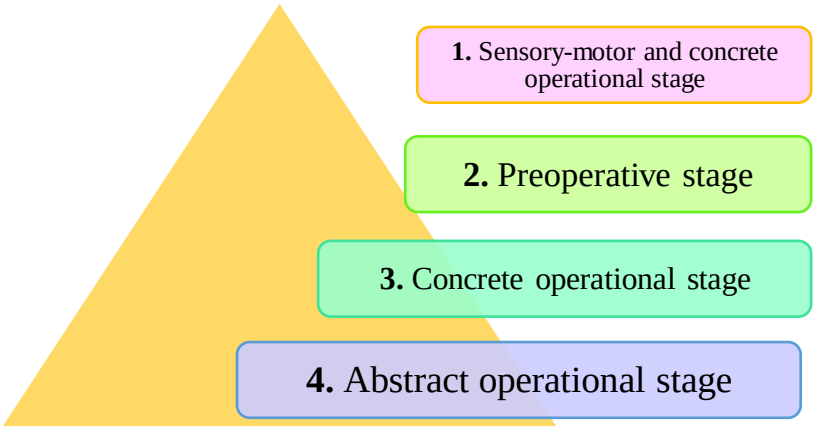

Figure 2. Stages of cognitive development of primary school-age students.

1. Sensory-motor and concrete operational stage. According to Jean Piaget's theory, children at this age are in the concrete operational stage of thinking, meaning they think more concretely, in terms of things that can be seen with the eye[1]. Visual and hands-on activities are important in teaching geometric shapes. This is because it is somewhat difficult to attract the attention of children at this age. At this age, the child's mind is scattered and playful.

2. Preoperational stage. At this stage, children use shapes and symbols to understand geometric concepts. For example, they try to connect drawn shapes with real objects. They express their thoughts through images, colors, and shapes, but they are not yet fully capable of abstract thinking. As children learn geometric shapes, they begin to distinguish similarities and differences and learn contrasting concepts between shapes. For example, differentiating between a triangle and a rectangle through their features, and differentiating between a flat shape and a three-dimensional shape.

3. Concrete operational stage. During this stage, children begin to think logically about concrete objects. They gain a clearer understanding of geometric shapes and their properties, such as angles and sides. During this stage, children develop the ability to classify shapes, place them in relation to each other, and understand their relationships.

Children increase their ability to understand geometric shapes through their transformations (such as rotation, size, and position). They are able to perform logical operations on shapes, which develops their ability to think abstractly.

4. Abstract operational stage. During this stage, children gain a deeper understanding of geometric concepts and develop their ability to think abstractly. They are able to use logical methods to solve complex geometric problems and in this process, they can more clearly express the relationships between concepts.

In the abstract operational stage, children can develop complex mathematical concepts about geometric shapes and their relationships. They learn to think based on geometric formulas and theorems.

Active learning and play: Piaget emphasizes the importance of learning through play. Children have the opportunity to reinforce their knowledge by using games and experiments in the process of learning geometric shapes. Games can give children a greater understanding of shapes, colors, and measurements.

Jean Piaget is based on dividing the process of children's mastery of geometric concepts into three main stages: sensorimotor, preoperational, and concrete operational stages. He emphasizes that children learn, understand geometric shapes, and develop logical thinking skills through experiments, games, and logical operations. These ideas are very important in the formation of geometric concepts in the educational process.

LITERATURE REVIEW ON THE TOPIC.

We all know that visual and practical exercises in mathematics lessons are effective. Visual thinking is the ability of a person to analyze and extract information

from objects that he sees with his eyes or creates in his imagination. It allows not only to see with his eyes, but also to understand what he sees, to determine the connections between them, to imagine shapes and to draw logical conclusions.

Rudolf Arnheim's book “Visual Thinking” (1969) studies how human thinking and visual perception are interconnected. According to him, thinking occurs not only through words, but also through images and shapes. In the book, Arnheim deeply analyzes the process of human formation of concepts and their consolidation in the mind through visual perception. Geometry and geometric concepts are an important part of this process.

One of Arnheim's main ideas is that geometric shapes are an important tool in the human thinking process[2]. According to him, geometric shapes are of fundamental importance in the creation of concepts and images in the human mind. He emphasizes that geometric concepts serve as the basic structure in human perception of the environment. For example, simple shapes such as a square, circle or triangle become the main elements of complex concepts in the process of visual thinking. Arnheim emphasizes that people can perceive and understand complex problems through geometric shapes and spatial relationships. He shows that geometric shapes are an effective tool for simplifying thinking and expressing complex issues visually. Geometry, in his opinion, enhances the ability of the human mind to think through specific shapes and relationships.

In Rudolf Arnheim's book "Visual Thinking", the understanding of geometric concepts is described as an integral part of human thinking. He deeply studied the important role that geometric shapes play in the process of visual perception and thinking, and emphasized that geometric concepts serve to develop human spatial and logical thinking. Therefore, geometric shapes can be used as effective tools for reinforcing concepts in the learning process of children.

Arnheim argues that visual thinking and imagination play an important role in enhancing human creativity. He shows that in the process of imaginative thinking, new ideas and solutions can be created through geometric shapes, colors and measurements. Developing imagination increases children's creative abilities. He believes that it is necessary to increase students' interest and encourage them to participate more actively by using visual materials, conditional images and interactive activities.

ANALYSIS AND RESULTS.

Along with the above scientists, the aforementioned scientist Zoltan Dienes has also conducted several studies to determine the level of understanding of geometric concepts by elementary school students. In his work “Developing Mathematics”, the scientist emphasizes the use of games and manipulative tools in learning mathematical concepts. He believes that children gain a deeper understanding of mathematical concepts through learning and experimentation through games. The scientist emphasizes the presentation of geometric concepts in various forms, with images, modeling, and

symbols. He notes that this allows students to understand the same mathematical concepts in different ways.

Zoltan Dienes offers an important approach to the process of learning geometric concepts. In his theory, he considers it necessary to take into account students' own experiences and intuitive feelings. The scientist believes that teaching geometric concepts to children not only through theoretical concepts, but also through direct practical experiments with them gives better results.

It is important to give younger school-age children the opportunity to learn through intuition and experience. Seeing shapes in different ways broadens students' minds. The scientist encourages students to solve problems and express themselves freely. Through the scientist's approach, students learn to learn on their own, conduct experiments, and apply their knowledge in practice. This leads them to learn geometric concepts more deeply.

In general, the scientist's approach is based on "learning through games." In this process, students learn geometric concepts through games and activities and apply them in practice. Dienes pays special attention to developing students' logical thinking skills. By teaching students geometric concepts, he aims to develop their analytical thinking skills.

Psychologist Lev Vygotsky, who conducted scientific research on the formation of geometric concepts in primary school children, shared valuable ideas on the formation of geometric concepts in children. According to the scientist, geometric concepts are formed in children in two ways (Figure 3):

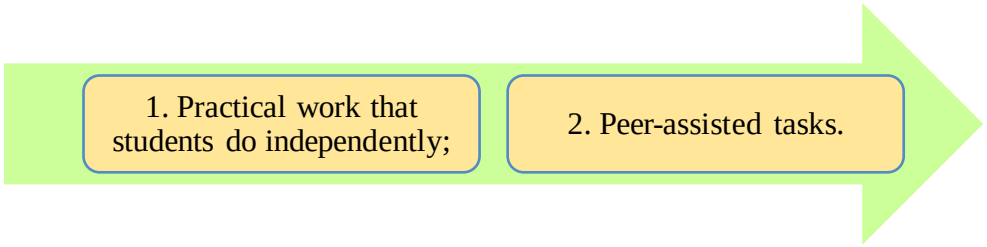

Figure 3. Ways of formation of geometric concepts.

The scientist noted that the main thing in the formation of geometric concepts by students is a task that the child can perform together with his peers. Because students communicate freely with their peers, exchange ideas, and there are no problems in solving problems together. The student communicates better with his peers than with the teacher. The scientist specifically mentioned that when teaching geometric concepts to the student, the teacher should initially help the student, and then reduce this help.

It is appropriate to cite the ideas of the Dutch scientist Van Hiele in the formation of geometric concepts in younger schoolchildren. Because the scientist conducted significant research in this area. He proposed his model for students to understand geometric concepts. This model includes several stages (Figure 4):

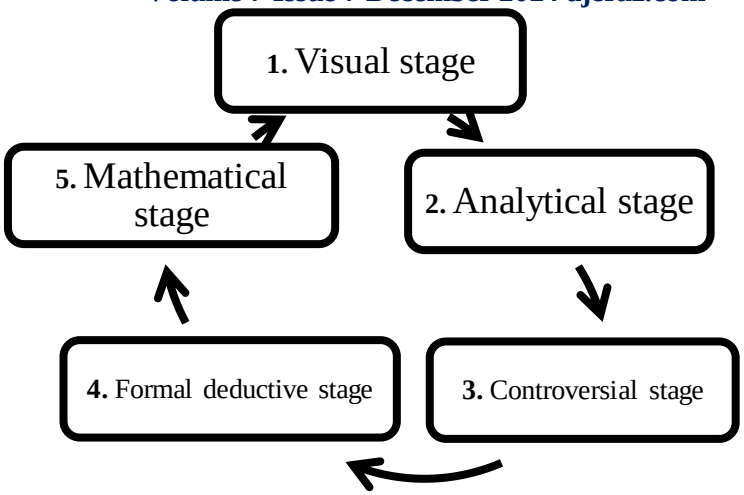

Figure 4. A model of students' understanding of geometric concepts (based on Van Hiele's proposal)

1. Visual stage: At this stage, students are divided into geometric shapes based on their general appearance. They are not qualified to describe or analyze shapes, but only name them based on the general appearance of the shape. Students at this stage name shapes based on their general appearance. Example: A triangle has three angles, while a rectangle has four angles.

2. Analytical stage: At this stage, students analyze shapes. They no longer divide shapes based on their appearance alone, but also learn about the properties of shapes (angles, sides, symmetry). Students now rely on more accurate information than in the previous stage.

3. Argumentative stage: At this stage, students are able to understand that shapes are interconnected. At this stage, students analyze how geometric shapes affect each other and draw conclusions. For example, they understand that a parallelogram is made up of a rectangle, and that the base of a pyramid is a triangle.

4. Formal deductive stage: At this stage, students can understand mathematical proofs and the deductive basis of theorems. They begin to independently study and prove geometric concepts and objects. With the help of proofs and axioms, it is possible to solve and analyze geometric structures. This stage develops students' higher abstract thinking, and students strive to be more independent.

5. Mathematical stage: This is the highest level in the Van Hiele mathematical model, and represents the level of students' ability to go beyond geometric combinations and understand mathematical elements abstractly and theoretically. At this stage, students analyze and conduct geometry from a deep mathematical perspective. At this stage, they strive to understand how mathematical systems work, how they arise, and the deeper foundations of mathematical logic, based on geometric shapes and their interrelationships alone[5].

Mathematicians David Tall and Shlomo Winner have developed interesting theories about the formation of geometric concepts. According to them, several key aspects are important for the development of geometric concepts in students ***(Figure 5):***

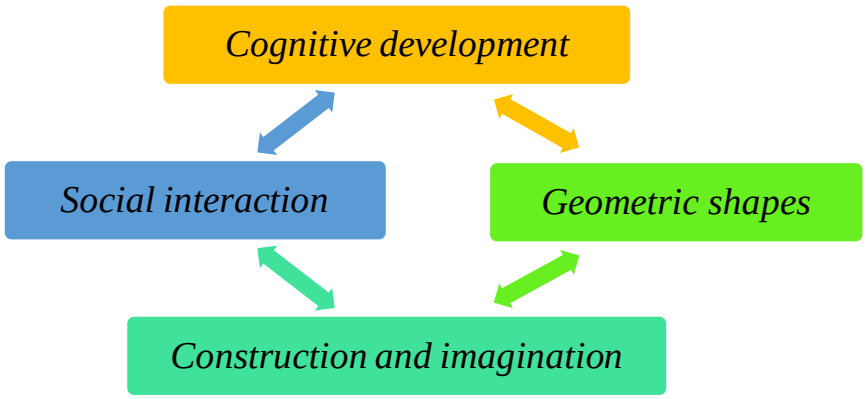

Figure 5. Important indicators of the development of geometric concepts in students (according to the classification of David Tall and Shlomo Winner)

Cognitive Development: Tall and Winner emphasize that children's cognitive development is important in the process of forming mathematical concepts. They emphasize that children learn through sensory experiences and hands-on activities in mastering geometric concepts.

Geometric Images: They talk about geometric images and their effects. Children develop their thinking by seeing and understanding geometric shapes. By combining shapes and comparing them with each other, children bring themselves closer to geometric concepts.

Construction and Imagination: In learning geometric concepts, children need to use their imagination to construct shapes and conduct experiments. Through this process, they form their own unique geometric concepts.

Social Interaction: Tall and Winner also emphasize the importance of children's interaction and cooperation in the learning process. Working in groups helps children explore different ideas and form new concepts.

Based on these considerations, it is interesting to note that in general education institutions, the process of mastering geometric concepts for primary school students demonstrates the importance of practice, visualization of geometric shapes, and social interaction.

CONCLUSION AND SUGGESTIONS.

Based on the above opinions of scientists in the formation of geometric concepts, the following conclusions and recommendations can be made:

1. When forming geometric concepts in primary grades, it is necessary to take into account the age and individual characteristics of students.

2. It is necessary to pay attention to the psychological processes taking place in children and develop them accordingly.

3. By demonstrating and visualizing lessons, it is possible to increase the student's interest in the lesson and the effectiveness of mastering.

4. It is important not to forget to use multimedia tools to improve the quality of teaching during mathematics lessons.

5. When forming geometric concepts, it is necessary to expand the scope of their imagination and develop cognitive skills.

References:

1. Jan Piaget “The Psychology of the Child”. Basic Books. Presses Universitaires de France, Paris. (1966) 221 page

2. Rudolf Arnheimning "Vizual fikirlash" (1969)

3. Dienes, Z. P. (2008). Mathematics Education and the Legacy of Zoltan Paul Dienes. Ukraina: Information Age Pub..

4. Dienes, Z. P. (1969). Building up mathematics. London: Hutchinson.

5. Hiele, P. M. v. (1986). Structure and Insight: A Theory of Mathematics Education. Buyuk Britaniya: Academic Press.

6. Hiele, P. M. v. (1957). De problematiek van het inzicht: gedemonstreerd aan het inzicht van schoolkinderen in meetkunde-leerstof. The problem of insight, in connection with schoolchildren's insight into subject-matter of geometry. Niderlandiya: sn.

7. Ахмедов, А. (2024). Boshlang ‘ich sinf matematika darslarida multimediali o ‘qitish texnologiyasining zamonaviy usullari va tamoyillarini qo ‘llash. Журнал универсальных научных исследований, 2(5), 970-976.

8. Ахмедов, А. (2024). Boshlang ‘ich sinf matematika darslarida “geogebra” ilovasidan foydalanishning ahamiyati (1-sinf misolida). Журнал универсальных научных исследований, 2(5), 977-985.

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