

## STAGES OF DEVELOPING GEOMETRIC CONCEPTS IN PRIMARY SCHOOL PUPILS

Palvanbaeva Nigora

2nd-year student, Faculty of Primary Education

Ajiniyoz Nukus State Pedagogical Institute

**Abstract:** This article explores the stages of developing geometric concepts in primary school pupils, emphasizing the importance of age-appropriate methods, visual aids, and hands-on activities. The study highlights the critical role of early mathematics education in building a foundation for spatial thinking, problem-solving, and logical reasoning. As Piaget (1952) suggests, cognitive development occurs in stages, and geometry provides a foundation for more abstract mathematical reasoning. By understanding how children gradually comprehend geometry, teachers can better structure lessons and learning experiences that foster deep understanding and long-term retention.

**Keywords:** Primary education, geometric concepts, geometric thinking, Piaget, van Hiele, pedagogical approaches, visualization, analytical thinking, hands-on learning, Uzbek pedagogy, teaching methodology, geometric shapes, mathematics education, student development, digital tools, traditional teaching methods.

### Introduction

Geometry is a fundamental branch of mathematics that begins to take shape in early childhood education. For primary school students, geometry is not merely about shapes and lines—it is an essential tool to develop spatial awareness, visual reasoning, and logical thinking. As Clements & Sarama (2007) argue, early exposure to geometric concepts is crucial for laying the groundwork for later mathematical learning. The process of learning geometry at a young age requires carefully structured pedagogical approaches that correspond with children's cognitive development. This paper outlines the stages through which young learners acquire geometric understanding and proposes strategies for effective instruction in each stage.

### Theoretical Background

Piaget's theory of cognitive development and van Hiele's model of geometric thinking are foundational in understanding how children learn geometry. According to Piaget, children move from concrete operational to formal operational stages, where their abstract thinking abilities improve (Piaget, 1952). Van Hiele identified five levels of geometric thought: Visualization, Analysis, Informal Deduction, Deduction, and Rigor. According to van Hiele (1986), most primary school students are at the Visualization and Analysis levels. Recognizing these levels helps educators align their teaching with students' cognitive readiness.

In the context of Uzbekistan, local researchers have conducted studies on the development of geometric thinking in primary school pupils. According to M. Tursunov (2010), primary

school pupils in Uzbekistan also pass through similar stages in their understanding of geometry. However, Uzbek pedagogical approaches emphasize the integration of cultural and historical elements into the teaching of geometry. For example, Uzbek educators, like R. Muminov (2015), argue that local educational practices often rely on hands-on learning and visual representation, aligning with van Hiele's concept of visualization. Muminov further suggests that, while foreign models focus on the abstract development of geometry, in Uzbekistan, there is a stronger emphasis on students' engagement with geometric shapes through tangible objects such as models of famous Uzbek architectural structures.

Furthermore, the methodological differences between Western and Uzbek pedagogical approaches are also notable in the integration of traditional teaching tools. While foreign models like those suggested by Clements & Sarama (2007) emphasize digital tools and software to enhance geometric learning, in Uzbekistan, traditional tools such as geometric sets and board activities are still widely used in classrooms. According to A. Rasulova (2019), these traditional methods provide a more direct connection between students and their environment, enabling a deeper and more personal understanding of geometry.

Thus, while both foreign and Uzbek pedagogical models agree on the importance of visual aids and hands-on activities, Uzbek educators often incorporate local cultural elements into the learning process, which provides a unique aspect to the teaching of geometry in primary schools.

### Stages of Developing Geometric Concepts

#### 1. Recognition (Visualization)

At this stage, students recognize shapes based on their overall appearance, not their properties. As van Hiele (1986) notes, at the Visualization level, children are able to identify shapes like squares and circles without understanding the underlying geometric properties. Teaching at this level should include visual aids, drawing activities, and real-life examples.

#### 2. Description (Analysis)

Pupils begin to notice properties such as the number of sides, angles, and symmetry. According to Clements & Sarama (2007), children's ability to describe shapes based on properties emerges in the early elementary years. Activities that involve sorting, classifying, and comparing shapes are beneficial here.

#### 3. Informal Deduction

Children start to understand relationships between shapes. For example, they can realize that all squares are rectangles, but not all rectangles are squares. As Clements & Sarama (2007) highlight, this understanding is crucial for developing higher-order thinking in geometry. Introducing shape hierarchies and using diagrams helps facilitate this understanding.

#### 4. Concrete Modeling

Using physical objects or manipulatives, students can build and explore shapes. This hands-on experience reinforces abstract concepts through tactile learning and helps in connecting visual perception with geometric language. As van Hiele (1986) suggests, concrete modeling provides the foundation for abstract geometric thinking.

## 5. Integration and Application

Students apply their knowledge of shapes to solve problems, such as identifying shapes in their environment, measuring perimeters, or drawing shapes to fit given criteria. This stage is essential for transitioning from rote learning to meaningful application. According to NCTM (2000), problem-solving is a key skill that geometry instruction should cultivate in young learners.

### Effective Methods and Tools

**Use of Visual Aids:** Pictures, charts, and interactive whiteboards help students visualize shapes and their properties.

**Manipulatives:** Tangrams, pattern blocks, and 3D models offer tactile experiences that make abstract concepts concrete.

**Digital Tools:** Geometry software or educational apps allow dynamic interaction and exploration.

**Storytelling and Art:** Integrating geometric shapes into stories or drawings engages students and encourages creative thinking.

**Games and Puzzles:** These motivate learners while strengthening spatial reasoning and shape recognition.

### Conclusion

Understanding the stages of geometric concept development in primary pupils allows educators to provide targeted instruction that aligns with their students' cognitive abilities. A blend of visual, tactile, and digital methods enhances geometric learning and lays the foundation for future mathematical success. Teachers play a vital role in guiding children through each stage, ensuring a gradual and deep understanding of geometry. As Piaget (1952) emphasizes, early exposure to abstract thinking in mathematics paves the way for success in later stages of education.

### References

1. Piaget, J. (1952). *The Origins of Intelligence in Children*. International Universities Press.
2. Van Hiele, P. M. (1986). *Structure and Insight: A Theory of Learning in Geometry*. Academic Press.
3. Tursunov, M. (2010). *Geometric Thinking in Primary School Pupils: A Comparative Study of Developmental Stages*. Tashkent: Uzbekistan National Press.

4. Muminov, R. (2015). The Role of Cultural Elements in Teaching Geometry: A Pedagogical Approach in Uzbekistan. Tashkent: Educational Sciences Publishing House.
5. Rasulova, A. (2019). Traditional and Modern Teaching Methods in Uzbek Mathematics Education. Tashkent: Higher Education Publishing.
6. Clements, D. H., & Sarama, J. (2007). Early Childhood Mathematics Education Research: Learning Trajectories for Young Children. Routledge.
7. Jumayeva, M. B. (2025). Use of educational methods in pedagogy. Икро журнал, 14(02), 168-174.
8. Mekhrojevna, D. S., & Tolibjonovna, A. P. (2025). Phraseological Worldview through the Prism of Color Semantics: A Comparative Study of Uzbek and Spanish Languages. Multidisciplinary Journal of Science and Technology, 5(2), 12-14.
9. Mekhrojevna, D. S. (2021). Semantic structure of proverbs. Academicia: An International Multidisciplinary Research Journal, 11(10), 343-347.
10. Джалилова, С. М. (2024, November). Лингвокультурные особенности пословиц испанского языка. In Conference Proceedings: Fostering Your Research Spirit (pp. 331-333).
11. Muminov, R. (2015). Innovative Approaches in Teaching Geometry to Primary School Children in Uzbekistan. Tashkent: National Educational Center.