



## THE USE OF VISUAL MODELS IN MATHEMATICS EDUCATION: A MODERN VIEW ON CONCEPT FORMATION

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**Abstract:** *Visualization is one of the key tools in modern mathematics education. This article explores the role of visual models in forming mathematical representations in schoolchildren, analyzes their advantages and impact on cognitive development, and examines digital resources that can significantly enhance teaching quality. The material is aimed at mathematics teachers who strive to increase clarity and effectiveness in instruction.*

**Keywords:** *visualization, clarity, learning models, information*

**Relevance of the Topic:** Modern students encounter vast amounts of visual information daily: graphs, interactive images, infographics, and digital interfaces. In this context, traditional mathematics instruction, based mainly on formulaic notation and abstract explanations, is no longer sufficient.

Students, especially in lower and middle grades, often struggle to understand the meaning of mathematical operations and logical constructions if they are not supported by visual aids.

Therefore, the use of visual models is not just a method, but a necessary condition for high-quality mathematics education. Visualization helps children connect abstract concepts with real-life situations, facilitates comprehension, reduces anxiety toward the subject, and makes learning more accessible for all categories of students.

**The Role of Visual Models in Education:** Visual models help students see what cannot be imagined by imagination alone. Through drawings, diagrams, charts, and interactive graphs, students have the opportunity to observe mathematical relationships in action.



## **Examples:**

-Learning proportions becomes easier when the child sees the analogy between the lengths of sides in a drawing.

-Understanding fractions is simplified when parts are represented as segments of a whole.

-The topic of functions becomes more tangible when each formula is transformed into a graph that changes in real time.

**Digital Resources for Visualization:** Digital visualization tools are particularly important. Programs such as Photomath, GeoGebra, and Desmos allow students to see the dynamics of mathematical processes: function graphs change as coefficients change, geometric shapes rotate, stretch, and intersect.

This turns the lesson into an investigation in which children become active participants rather than passive listeners.

**Methodological Approaches:** Integrating visual models into the explanation of new material promotes deeper and more lasting understanding. It is important for the teacher not just to demonstrate an image, but to build a discussion around it: ask questions, encourage comparisons, and look for patterns.

**Example:** When introducing the concept of a quadratic function, several graphs of different parabolas can be shown, and students can be asked to determine how their positions change. This approach develops analytical thinking and the ability to draw conclusions.

Equally important is the gradual transition from images to symbolic representation. At the initial stages, the child works with a picture, then translates what is seen into a table or diagram, and only after that into a formula.

## **Student-Created Visual Models**

An effective technique is having students create visual models themselves. When a child builds a graph, draws a problem diagram, or creates a geometric figure model independently, they gain a better understanding of the problem's structure and solution logic. This develops modeling skills, one of the most important competencies of the 21st century.



**Conclusion:** The use of visual models in mathematics teaching allows the teacher to significantly enhance the quality of instruction. Visualization helps students comprehend abstract concepts, develops logical thinking, and makes lessons more accessible and engaging. In the context of the digitalization of education, its role is becoming increasingly important.

The skillful application of visual tools transforms learning into an engaging and understandable process, contributes to the formation of lasting knowledge, and develops students' ability to apply mathematics in real life. Thus, visual models become not merely an auxiliary technique, but an essential component of modern teaching methodology.

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