



## GENERALIZATION OF MATHEMATICAL CONCEPTS IN PRIMARY EDUCATION

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### ABSTRACT

*In primary school (Grades 1–4), the generalization of mathematical concepts is regarded as one of the central didactic principles and instructional approaches in mathematics, in accordance with the State Educational Standards of the Republic of Uzbekistan. In line with these standards, the teaching process is designed to develop pupils' ability to organize mathematical knowledge systematically, identify common and essential characteristics of objects and phenomena, and move from specific examples to broader rules and patterns.*

According to the State Educational Standards of the Republic of Uzbekistan, one of the priority objectives of primary general education is not only the acquisition of specific knowledge and skills, but also the development in younger schoolchildren of the ability to generalize observed facts, identify essential features, move from the particular to the general, and apply the conclusions obtained in new situations.

The generalization of mathematical concepts serves as a key didactic principle and methodological approach

that permeates the entire mathematics course in Grades 1–4. This process enables students to consciously systematize their accumulated understanding of numbers, operations, geometric figures, quantities, and relationships, thereby forming a holistic picture of mathematical reality. Gradual and repeated generalization facilitates the transition from inductive reasoning to deductive reasoning, develops abstract thinking as well as skills of analysis and synthesis, and lays the foundation for the successful mastery of



more complex mathematical disciplines at subsequent stages of education.

In the context of implementing modern requirements for the quality of education in the Republic of Uzbekistan, purposeful work by the teacher in organizing generalizing stages of lessons, selecting tasks aimed at identifying patterns, and formulating rules acquires particular significance. This article is devoted to examining the essence, stages, methods, and psychological and pedagogical conditions for the effective generalization of mathematical concepts in primary school, as well as analyzing their reflection in the current curricula and mathematics textbooks for Grades 1–4 of general secondary schools in Uzbekistan.

The generalization of mathematical concepts in primary school represents a purposeful process of moving from individual, concrete representations to more general, abstract knowledge, identifying essential features, and formulating rules and patterns. In accordance with the State Educational Standards of Primary Education of the Republic of Uzbekistan, generalization is one of the leading didactic principles that ensures the systematization and conscious understanding of mathematical knowledge.

The process of generalization in primary grades is carried out step by step and is based on the age-related characteristics of younger schoolchildren. At the first stage (predominantly Grades 1–2), inductive generalization prevails: through observing multiple specific examples (for example, addition within 10, 20, and 100), students identify a general method

of action and arrive at conclusions about the properties of operations (the commutative and associative properties of addition). This approach corresponds to the principles of visualization and gradual progression enshrined in the standards.

At the second stage (Grades 3–4), the role of deductive generalization increases: from a general rule (for example, the rule of multiplying by 10 or 100), students proceed to apply it in new specific situations. Here, exercises involving classification, comparison, and contrast are important, as they contribute to the development of analytical and synthetic thinking activities.

Generalization permeates all the main strands of the primary mathematics course:

1. Number sequence and arithmetic operations. Students generalize the concepts of natural numbers and place value composition, moving from specific calculations to general methods (algorithms for column addition and subtraction, multiplication, and division). Example: after examining multiple examples such as  $25 + 3$  and  $36 + 4$ , a rule for adding a one-digit number to a two-digit number is formulated.

2. Geometric concepts. The generalization of figures occurs through identifying essential features: from specific triangles (scalene, isosceles) to the concept of a “triangle” as a closed broken line with three vertices and three sides. Similarly, the concepts of polygon, angle, perimeter, and area are formed.

3. Quantities and measurement.

Students generalize relationships between quantities (length, mass,



volume, time), moving from comparisons such as “greater-less” to establishing units of measurement and their relationships (1 m = 100 cm, 1 kg = 1000 g). This lays the foundation for understanding the decimal system.

4. Solving word problems and logical exercises. Generalization here is manifested in identifying types of problems (finding a sum, difference, product, etc.), developing general solution plans, and formulating inverse problems. Logical tasks promote the generalization of relationships such as “part-whole,” “greater/less by...,” and “times as many.”

The effectiveness of generalization depends on observing psychological and pedagogical conditions: repeated practice in different contexts, the use of visual models (counting sticks, geometric figures, tables, diagrams), a combination of collective and individual work, and the inclusion of elements of problem-based learning (tasks such as “Find the pattern” and “Formulate the rule”). It is also important to organize stages of

generalization within the lesson: activation of prior knowledge → analysis of examples → identification of essential features → formulation of the rule → application in new tasks → reflection.

In the current mathematics textbooks for Grades 1–4 of general secondary schools in Uzbekistan (approved by the Ministry of Public Education), generalizing tasks are systematically included at the end of thematic units, in review sections, and in final assessment works, which fully corresponds to the requirements of the State Educational Standards. The purposeful use of generalization as a teaching method makes it possible not only to consolidate specific skills but also to develop mathematical thinking in younger schoolchildren, readiness for abstract reasoning, and the ability to transfer knowledge to new situations, which is one of the key competencies предусмотренных the national educational standards of the Republic of Uzbekistan.

### References:

1. Государственный образовательный стандарт начального общего образования Республики Узбекистан (по математике). – Ташкент: МНО РУз, 2023.
2. Байрамукова П.У., Уртеннова А.У. Методика обучения математике в начальных классах. – Ростов н/Д: Феникс, 2009.
3. Артемов А.К. Обучение математике в начальных классах. – М.: Просвещение, 1984.
4. Осіпова А.В. Формирование математических понятий в начальной школе. – Пенза: ПГПУ, 2015.
5. Беспалько В.П. Педагогика и прогрессивные технологии обучения. – М.: Изд-во, 1995.
6. Заяц Ю.С. Методика преподавания математики в начальных классах. – Брест: БрГУ, 2018.
7. Харитоновна И.В. Методы обучения на уроках математики в начальной школе. – 2020.



8. Шепель А.В. Формирование математических понятий на основе информационно-категориального подхода. – Дисс. ... канд. пед. наук. – 2010.
9. Учебная программа по математике для 1–4 классов общеобразовательных школ Республики Узбекистан (2024–2025 уч. год). – Ташкент: МНО РУз, 2024.