

## **USING TIMSS – FORMAT TASKS TO DEVELOP INDUCTIVE AND DEDUCTIVE REASONING**

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**Annotation.** This article addresses the issue of developing inductive and deductive reasoning skills in primary school students. Induction is analyzed as a form of thinking that leads students to general conclusions based on observations, while deduction is presented as the application of general rules and patterns to specific situations. The use of these methods in primary mathematics education is shown to have a positive impact on the formation of logical thinking, the ability to justify one's opinion, analyze evidence, and draw accurate conclusions.

The article also examines the content and cognitive domains of the TIMSS (Trends in Mathematics and Science Study) international assessment program and analyzes the possibilities of applying them in primary education. It is argued that through TIMSS tasks, students can develop skills in analyzing real-life situations, using mathematical models, identifying logical relationships, understanding cause-and-effect connections, and providing justification for their reasoning.

**Keywords:** inductive reasoning, deductive reasoning, logical thinking, TIMSS tasks, primary education, mathematics lessons, methodology, development of thinking, international assessment, cognitive skills.

In today's era of globalization, one of the pressing issues in the education system is not only ensuring that students acquire knowledge, but also developing their ability to analyze, generalize, apply knowledge in practical situations, and draw sound conclusions based on evidence. From this perspective, inductive and deductive reasoning play an important role in fostering students' logical thinking.

The process of primary education is considered a foundational stage in the formation of human thinking. It is at this stage that special attention must be given to developing students' skills in logical reasoning, argumentation, and understanding cause-and-effect relationships. By fostering inductive and deductive reasoning, students not only memorize mathematical concepts but also comprehend their essence and learn to apply them in new situations.

The results of international studies, in particular TIMSS (Trends in Mathematics and Science Study), assess not only the extent to which students acquire ready-made knowledge but also their ability to apply knowledge, analyze information, and draw logical conclusions in different contexts. Therefore, the use of TIMSS tasks in the educational process creates broad opportunities for developing students' inductive and deductive reasoning.

In Uzbekistan's education system, the implementation of methodologies aligned with international standards, preparing students for modern assessment

criteria, and fostering their logical thinking are urgent issues. Especially in primary school, the development and practical application of methodologies based on TIMSS tasks aimed at forming students' inductive and deductive reasoning has both scientific-theoretical and practical significance.

Inductive and deductive reasoning, as the main forms of human logical thinking, have long been studied in philosophy, logic, and pedagogy. Aristotle was the first to interpret deductive reasoning as the basis of scientific knowledge, while Francis Bacon justified the inductive method as an important tool for studying nature. In later periods, both methods began to be applied effectively not only in the process of philosophical inquiry but also in education and upbringing.

International studies — TIMSS, PISA, and PIRLS — also pay special attention to students' inductive and deductive reasoning abilities when assessing their knowledge levels. This is because the modern educational process is not limited to acquiring knowledge, but also requires the ability to apply it, adapt it to new situations, and approach problems creatively.

Therefore, the theory of developing inductive and deductive reasoning has secured a strong position not only in psychological and pedagogical research but also in the scientific foundations of international assessment systems.

One of the international assessment programs, TIMSS (Trends in Mathematics and Science Study), is aimed at measuring not only students' knowledge in mathematics and science but also their ability to apply it in practice. This study involves students of the 4th and 8th grades. Hence, preparing students for TIMSS-type tasks from the early years of primary education is considered crucial for their future success.

### Main Features of TIMSS Tasks

1. Based on real-life situations – the problems are connected to everyday events. For example, buying fruit at the market, reading a transport schedule, or analyzing information from a diagram.
2. Presented in visual form – many tasks are expressed through pictures, tables, graphs, and diagrams. This requires students to read and analyze visual information.
3. Require logical analysis – not only calculation is necessary, but also identifying cause–effect relationships, drawing general conclusions, and applying rules.
4. Cover different cognitive levels – TIMSS tasks test not only knowledge recall but also the ability to apply and analyze knowledge.

### Opportunities for Developing Inductive and Deductive Thinking

TIMSS tasks provide great opportunities for developing inductive and deductive reasoning:

- Inductive thinking – students are encouraged to derive a rule or conclusion from the given information. For example, by comparing the areas of different geometric shapes, they can discover a general pattern.

- Deductive thinking – students are directed to solve a new situation based on an existing rule. For instance, questions such as: “If the length increases by 1 cm, how does the perimeter change?”

Example of a TIMSS-style question:

The picture shows the amount of water in different containers. Which container has the most water? If 2 more liters of water are added to each container, which one will contain the most water then?

This task requires the student to first observe (induction) and then draw a conclusion based on a rule (deduction).

### Developing Inductive Thinking through TIMSS Tasks

In primary school students, the development of inductive thinking is carried out by teaching them to observe independently, generalize, and formulate rules. TIMSS-format tasks are very suitable for this process, as they encourage students to compare and analyze different situations.

#### Stages of Developing Inductive Thinking

1. Observation – students examine the given picture, table, or data.
2. Comparison – they identify similarities and differences.
3. Generalization – based on the similarities found, they formulate a general rule or conclusion.
4. Conclusion – the rule is applied to new examples.

Developing inductive and deductive reasoning skills in primary school students is one of the most important tasks of today’s educational process. Through inductive reasoning, students learn to derive general conclusions from individual facts and examples, while deductive reasoning allows them to analyze new situations using general rules.

TIMSS-format tasks serve as an effective tool in this process, as they are based on real-life situations, presented visually, and require thinking at different cognitive levels. With the help of TIMSS tasks, students develop not only mathematical knowledge but also the skills of observation, generalization, analysis, conclusion-making, and justification.

Thus, the regular use of TIMSS-format tasks helps achieve high efficiency in developing inductive and deductive reasoning skills in primary school students. In turn, this creates a solid foundation for their successful participation in international assessment programs.

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