

METHODOLOGY FOR TEACHING ADDITION AND SUBTRACTION
WITHIN 100 – THEORETICAL FOUNDATIONS, PRACTICE, AND
EFFECTIVENESS

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Abstract: *One of the fundamental concepts of elementary mathematics is the operations of addition and subtraction within 100. Teaching these operations correctly and effectively is crucial for strengthening pupils' mathematical thinking, number sense, and computational skills. At the same time, appropriate methodologies contribute to the development of logical reasoning, calculation abilities, and students' interest in mathematics. Special emphasis is placed on instructional methods that correspond to learners' age characteristics and make the learning process engaging and effective.*

Keywords: *addition within 100, subtraction within 100, addition operation, subtraction operation, elementary mathematics, visual aids, mathematics teaching methodology, game-based learning technologies, number concept.*

Аннотация (Russian): *Одной из основных тем в курсе начальной математики является обучение сложению и вычитанию чисел в пределах 100. Правильное и эффективное преподавание данного материала играет важную роль в формировании математического мышления учащихся, углублении их представлений о числе и развитии вычислительных навыков. Используемые методики способствуют развитию логического мышления, повышают интерес к математике и делают учебный процесс более эффективным и увлекательным. В исследовании особое внимание уделено использованию игровых и наглядных методов, соответствующих возрастным и психологическим особенностям младших школьников.*

Ключевые слова: *сложение в пределах 100, вычитание в пределах 100, операция сложения, операция вычитания, начальная математика, наглядные средства, методика преподавания математики, игровые образовательные технологии, понятие числа.*

INTRODUCTION

In the process of primary education, one of the most important components of mathematical preparation is teaching the operations of addition and subtraction. This topic serves as the foundation for students' subsequent mathematical knowledge, as the formation of arithmetic skills, the development of logical thinking, and the ability to solve practical problems largely depend on how effectively this process is organized.

Conscious and meaningful performance of addition and subtraction within 100 strengthens pupils' arithmetic representations and creates a basis for intellectual development, the formation of calculation culture, and independent decision-making in everyday situations.

The relevance of this topic lies in the fact that modern education increasingly requires not only the development of mechanical calculation skills, but also logical-analytical thinking, strategic approaches, and readiness to solve practical problems. If the methodology of teaching addition and subtraction within 100 is effective, students perform operations consciously, are able to choose different strategies, analyze the calculation process, and independently identify and correct their mistakes.

Furthermore, understanding the relationships between numbers, number composition, and the essence of arithmetic operations facilitates the mastery of more complex topics in subsequent grades.

The purpose of this study is to analyze modern methodologies for teaching addition and subtraction within 100 in primary grades, to substantiate effective methods and technologies, and to develop methodological recommendations aimed at forming stable arithmetic skills in pupils.

The Concept of Addition and Subtraction. Addition and subtraction represent the core forms of summation and difference processes. For primary school pupils, it is important to explain these operations not only as abstract numerical procedures, but also as tools for solving real-life problems.

For example, through addition within 100, pupils:

- Perceive increase in quantity: If there are 25 apples and 17 more are added, how many are there in total? This introduces the fundamental mathematical concept of increase.
- Understand decrease through subtraction: If there are 50 chocolates and 18 are eaten, how many remain? This reinforces the idea of decrease.

In addition, addition and subtraction develop logical thinking, help pupils determine when and how to apply operations, enhance comparison skills (identifying larger or smaller numbers), and foster grouping and classification abilities. They also support solving everyday problems, such as calculating money while shopping or adding and subtracting points in games.

Thus, addition and subtraction serve not only as numerical operations but also as essential tools for understanding mathematical logic in daily life.

Theoretical Foundations

Addition is the result obtained by combining two or more numbers. In mathematical terms, if we have numbers a and b , their sum is expressed as $a + b$. The definition of addition is based on the inductive definition proposed by German Grossmann (1809–1877), which consists of two parts:

- Adding 1 to any natural number a yields the successor of a :
- $(\forall a \in \mathbb{N}) (a + 1 = a')$
- The operation $a + b'$ produces the successor of $a + b$:
- $(\forall a, b \in \mathbb{N}) [(a + b') = (a + b) + 1]$

According to Peano's second axiom, if n is a natural number, then $n + 1$ is also a natural number. Thus, if a and $a + b$ are natural numbers, then $a + b' = (a + b)'$ is also a natural number. From $a + 1 = a'$ and Peano's fourth axiom, it follows that the sum of any two natural numbers is well-defined and itself a natural number.

Therefore, addition is a single-valued operation that is always defined on the set of natural numbers. From the definition of addition, it is evident that any natural number is equal to the sum of its predecessor and one. Based on this principle, the addition table of one-digit numbers is constructed.

If, in the sequence of natural numbers, we count b numbers following a , the last counted number is the sum of a and b , denoted as $a + b$. Here, a is the first addend, b is the second addend, and $a + b$ is the sum.

When teaching children, the following properties should be illustrated with examples:

Properties of addition and subtraction:

1. Associative property: $(a + b) + c = a + (b + c)$
2. Commutative property: $a + b = b + a$
3. Non-commutativity of subtraction: $a - b \neq b - a$

Addition and Subtraction within 100

Teaching addition and subtraction within 100 is one of the most important directions in primary mathematics education. Through this topic, pupils learn the meaning of numbers, relationships between them, and quantitative changes. These operations are significant not only as arithmetic processes but also as the initial stage of logical reasoning and analysis.

Addition represents the process of combining quantities to obtain a larger amount. For example, if a child has 23 candies and receives 15 more, the total becomes $23 + 15 = 38$. This helps pupils understand that adding numbers increases the result.

Subtraction, on the other hand, involves removing part of a quantity, resulting in a smaller number. For instance, if 25 pencils are used from 70, the remainder is $70 - 25 = 45$. Pupils learn that the result of subtraction is smaller than the initial number.

Addition and subtraction within 100 also deepen understanding of tens and ones. For example:

$$57 + 23$$

$$50 + 20 = 70$$

$$7 + 3 = 10$$

$$70 + 10 = 80$$

This method teaches pupils to decompose numbers and perform operations step by step.

Moreover, pupils grasp the inverse relationship between addition and subtraction. If $48 + 27 = 75$, then $75 - 27 = 48$ and $75 - 48 = 27$. This fosters logical analysis and reverse thinking.

Thus, teaching addition and subtraction within 100 develops not only computational skills but also comparison, analytical thinking, and problem-solving abilities. These

competencies form the foundation for mastering more complex arithmetic and algebraic concepts in later grades.

Decomposition into Tens and Ones

$$47 + 36 = (40 + 30) + (7 + 6) = 70 + 13 = 83$$

$$92 - 47 = (90 - 40) + (2 - 7) = 50 - 5 = 45$$

This approach helps children understand relationships between numbers.

Didactic Approaches and Methodologies

Various methodologies are used to teach addition and subtraction in primary school mathematics.

1. Use of Visual Aids

Concrete models and manipulatives such as apples, coins, notebooks, and cubes help pupils grasp abstract concepts. For example: “There are 2 apples, and 3 more are added. How many apples are there now?” Visual aids help pupils perceive numerical changes concretely.

2. Number Line and Diagrams

Using a number line from 0 to 100 allows pupils to visualize increase and decrease. Addition moves to the right, subtraction to the left, reinforcing logical sequencing.

3. Interactive Methods and Game-Based Learning

Games such as “Addition Cards” or “Shopping Game” engage pupils and promote calculation, communication, and reasoning skills.

4. Digital Games and Interactive Programs

Modern applications such as Math Kids, Quick Math, and Khan Academy Kids enable independent practice, immediate feedback, and individualized learning pace.

5. Practice and Repetition

Regular exercises consolidate arithmetic skills. For example:

$$12 + 34 = ? \quad 45 + 28 = ?$$

$$90 - 46 = ? \quad 50 - 27 = ?$$

International Experience

Singapore: CPA (Concrete–Pictorial–Abstract) and Bar Model. The CPA approach progresses from manipulatives to visual models and finally to abstract notation. Bar models are particularly effective for word problems.

Montessori: Individualized Learning with Manipulatives

Materials such as golden beads and stamp games help pupils understand place value and operations through hands-on experience.

Finland: Game-Based, Stress-Free, Contextual Learning

Lessons emphasize intrinsic motivation, projects, and real-life contexts, fostering deep understanding without pressure.

Japan: Soroban and Mental Arithmetic

The soroban (abacus) strengthens place value understanding and supports rapid mental calculation (anzan).

United States: Conceptual Understanding and Strategies

Instruction focuses on multiple strategies (number bonds, making ten, decomposition, compensation) and problem-solving.

Combining effective elements from these approaches—CPA, games, manipulatives, mental arithmetic, and strategic problem-solving—ensures deep, engaging, and effective learning of addition and subtraction within 100.

Conclusion. Teaching addition and subtraction within 100 is a crucial stage in primary mathematics education. It develops pupils' understanding of quantitative changes, logical thinking, analysis, and comparison skills.

The use of visual aids, number lines, diagrams, real-life examples, games, interactive tasks, and digital tools fosters positive attitudes toward mathematics and enhances learning effectiveness.

Taking into account individual differences, encouraging pupils, and valuing their achievements further increases educational outcomes.

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