

**A STUDY ON THE MASTERY OF FUNDAMENTAL
MATHEMATICAL FACTS AMONG SLOW LEARNER CHILDREN**

Dr. Ajay Kumar Mishra
Professor & Vice Chancellor
Sikkim Skill University
Namthang, Sikkim

ABSTRACT

Knowledge of low-level mathematical facts is the foundation of upper-level mathematical reasoning and solving of problems. Nevertheless, those children who were labeled as slow learners usually have a long-term struggle to master the fundamentals of fluency in arithmetic. This paper is a theoretical and analytical exploration of the characteristics of basic mathematical facts, cognitive obstacles in learning the subject of slow learner children, and systematic pedagogical interventions to enhance the mastery. The paper combines mathematics background with a teaching theory, providing formal definitions, extensive examples, elementary theorems with proofs, and structure of solutions. A conceptual learning model is presented to improve the acquisition of the facts by means of repetitions, visualizations, and conceptual scaffolding. The research stresses that a systematic teaching based on mathematical structure can be used to a large extent in enhancing accuracy, retention and confidence of slow learner children.

Keywords: *Slow learners, mathematical facts, arithmetic fluency, learning difficulties, basic operations, conceptual understanding, pedagogy.*

1. INTRODUCTION

Mathematics is cumulative in nature and every new concept is very dependent on the safe mastery of previous skills. Mathematical education involves both simple numeracy and more complex abstract thought, and proficiency in simple concepts at an early age is essential. The basic mathematical principles, namely, the operations of addition, subtraction, multiplication, and division within small numerical domains are the keystone of all further developments in mathematics. These facts allow learners to interact freely with the problem solving, algebraic reasoning and the higher order mathematical reasoning. In cases where there is a weak or unstable nature of such underlying knowledge, learners are faced by sustained challenges that hinder their academic growth in more than one area.

As the research on numerical cognition points out, automaticity in basic arithmetic facts lowers the cognitive load leaving the working memory resources to be devoted to conceptual comprehension and

solving more complicated problems. On the other hand, low proficiency in these lower-level procedures causes learners to count with ineffective counting methods thus slacking down the process and making them likely to make mistakes. Consequently, poor achievement of basic facts often culminates in mathematics anxiety, lack of self-confidence, and lack of interest in the learning process, especially when one is introduced to abstract mathematical concepts.

The slow learner children form a special category in the learning continuum. They do not qualify as intellectually disabled, but generally have a below-average performance in school and take a long time to learn and learn with structured assistance. Slow learners in mathematics commonly have poor number sense, weak conceptualization, poor retention of arithmetic knowledge and slow processing speed. These features have a dramatic impact on their generalization knowledge, identification of numerical patterns, and a transfer of learned processes to new situations. As a result, they have high obstacles to advancement between concrete arithmetic operations and symbolic representation and algebraic reasoning.

The difficulties of the slow learner children cannot be explained by the lack of practice only; they are deeply connected to such cognitive aspects as limitations of working memory and attention as well as inadequate conceptual background. The classical modes of teaching that focus on rote memorization without conceptualization often do not help in solving these underlying challenges. Modern educational studies thus support pedagogical methods that combine conceptual knowledge with procedural fluency, utilizing visual images, manipulatives, decompositional methods and reinforcement to build mathematical learning.

In this respect, an intervention that is mathematically based is necessary to develop a successful intervention. The arithmetic properties which are basic, such as commutativity, associativity, and distributivity, are regulated by established algebraic properties. In case these structural principles are explicitly described by means of directed teaching and exemplary modeling, the learners will be able to decrease a cognitive load, form relationships between facts, and design flexible methods of computation. This will be especially useful with slow learners who can then be introduced to isolated arithmetic facts being converted into conceptual networks.

2. REVIEW OF LITERATURE

Farooq and Aslam (2017) examined instructional methods that could be used to help slow learners in mathematics at primary school level. They studied interventions in the classroom that focused on individualized instruction and constant assessment and practice. The authors found out that students

with slow learning processed in basic arithmetic skills when teachers used differentiated instructions and gave them repetitive chances to be guided showed significant improvement. The results indicated the relevance of adjusting both learning speed and content to reflect the cognitive abilities of the learners, and it was concluded that the supportive learning conditions promoted mathematical performance in slow learners to great extents.

Aprinastuti et al. (2020) have suggested and tested Montessori-based mathematical manipulatives, specifically tailored to slow learners and students with dyscalculia at the elementary level. They have conducted a research on how effective concrete learning materials are in facilitating conceptual understanding of numbers and operations. The authors noted that students that interacted with physical manipulatives had better engagement, understanding of mathematical concepts and remembrance of arithmetic facts. The paper highlighted that multisensory learning tools were effective to meaningful learning experiences by helping to bridge the gap existing between abstract symbols and concrete representations.

Listiawati et al. (2023) examined the application of the principles of Realistic Mathematics Education (RME) to increase the mathematical competence of slow learner students. Their own work embraced the contextual modes of learning the linking of mathematical concepts to life. The findings revealed the students that were exposed to RME strategies showed considerable improvements in problem solving skills, conceptual knowledge and procedural fluent knowledge. The authors concluded that the contextualized instruction was more likely to engage students in active learning and promote more profound mathematical thinking, which was especially efficient with the learners who experienced difficulties in learning abstract teaching methods.

Abdul-Rahman (2020) studied the efficiency of learners control and program control teaching method in helping slow learners to develop their mathematical thinking skills. The researchers contrasted the conditions in which students were in charge of their learning speed with those in which they were mainly driven by the structure of instruction programs. The results showed that learning environments of the learner control type encouraged a high degree of autonomy, motivation and analytical thinking whereas the program-based strategies favored systematic learning of skills. The study proved that the combination of the two methods in a balanced manner led to better mathematical reasoning and learning outcomes among slow learners.

3. CONCEPTUAL FRAMEWORK

Any meaningful analysis of arithmetic mastery would require a clear comprehension of the characteristics of learners and mathematical constructs which are under investigation. In this section, the operational definitions of slow learners are defined and the concept of basic mathematical facts are formalized. Through the synthesis of the learning approaches with the mathematical notation, the framework helps to understand the mental image of the learners and the structure of the basic arithmetic, thus, creating the background to the further theoretical dialogue and modeling of the teaching.

3.1. Definition of Slow Learners

A slow learner refers to a child who learns academic knowledge and skills significantly slower than his or her age mates, but who, nevertheless, does not have diagnostic intellectual disability. These learners normally operate within an Intelligence Quotient (IQ) range of 70-90 and are characterized by a lack of speed in processing information, working memory, attention, and conceptual integration. Such cognitive features are usually portrayed in a slow pace of learning literacy and numeracy abilities, inability to memorize acquired data, and inability to apply known information in different contexts.

Within the field of mathematics, slow learner children have often had to face a consistent setback in learning how to relate numbers, remembering arithmetical facts and how to use the processes they have learned to solve problems. Their learning pattern is marked by the necessity to have long periods of instruction, repetition, systematic direction, and tangible or pictorial illustration of the abstract ideas. Systematic reinforcement and scaffolded instruction are usually useful in teaching slow learners, unlike the students with specific learning disabilities; they are experiencing problems all around and not in any particular field.

Educationally, sluggish learners can have some meaningful mathematical knowledge when the instructions are coordinated with their cognitive picture. Studies indicate multisensory instructions, step-by-step transition between concrete and abstract concepts, and the use of constant formative feedback importance. The identification of slow learners as a specific educational population highlights the importance of adaptive instructional methods that put the stress on the clarity of concepts and the use of procedures.

3.2. Fundamental Mathematical Facts

Let

$$\mathbb{N} = \{0, 1, 2, 3, \dots\}$$

denote the set of natural numbers.

Fundamental mathematical facts refer to the rapid and accurate recall of outcomes associated with the four basic arithmetic operations performed on small natural numbers:

- **Addition:** $a + b$
- **Subtraction:** $a - b$
- **Multiplication:** $a \times b$
- **Division:** $a \div b$, where $b \neq 0$

typically within the range

$$0 \leq a, b \leq 10.$$

They are the fundamental operations of numerical fluency that can be considered the prerequisites of mathematical reasoning of higher order. The problem-solving Mastery of such facts helps learners to make calculations effectively without over use of counting strategies, thus releasing mental energy to conceptual knowledge and problem solving.

Mathematically, these operations are subject to basic frameworks of algebraic properties of commutativity, associativity, identity, and distributivity. Indicatively, addition is commutative,

$$a + b = b + a,$$

while multiplication distributes over addition,

$$a(b + c) = ab + ac.$$

Learners can be motivated to learn these properties because, in this way, they can identify the patterns in the numerical facts and work out the flexible methods of calculation instead of memorizing isolated findings.

In the case of slow learner children, the basic mathematical facts are not just the memorization processes but the conceptual constructions which should be created systematically, step by step, through the experiences, visualizations, and guided practice. Among the concrete models, counters, number lines, array, and grouping activities aids in filling the gap between abstract symbols and concrete meaning. The internalization is strengthened by repeated exposure to structured examples, and the efficient mental computation is supported by decomposition strategies (*e.g.* $8 + 5 + 3 = 8 + 2 + 3$).

Key mathematical facts are therefore procedural knowledge and conceptual knowledge. Their skill is vital in developing arithmetic fluency, developing mathematical confidence and facilitating their progress to higher levels in fractions, algebra, and proportional reasoning.

4. MATHEMATICAL FOUNDATIONS

Effective teaching techniques especially to the slow learner children have a strong theoretical knowledge of the elementary arithmetic operations. Basic mathematical facts are never some isolated calculations but are determined by clear algebraic properties that expose nature numerical structures. By having these properties taught explicitly, learners can avoid having to rely on rote memorization to address them, and they can instead build flexible and concept-based methods of calculating. This part introduces major mathematical backgrounds, namely the rules of addition and multiplication, formal theorems, proofs, and instructional implications underpinning the mastery of arithmetic among slow learners.

4.1. Properties of Addition

Addition is the most basic arithmetic operation and forms the conceptual basis for subtraction, multiplication, and division. Two central properties of addition—commutativity and associativity—play a crucial role in simplifying computations and building efficient mental strategies.

Theorem 4.1 (Commutativity of Addition)

For all $a, b \in \mathbb{N}$,

$$a + b = b + a.$$

Proof

Using the Peano axioms, addition is defined recursively as:

$$a + 0 = a, a + S(b) = S(a + b),$$

where $S(b)$ denotes the successor of b .

We prove the result by mathematical induction on b .

Base case:

For $b = 0$,

$$a + 0 = a = 0 + a.$$

Inductive step:

Assume $a + b = b + a$ holds for some b . Then,

$$a + S(b) = S(a + b) = S(b + a) = S(b) + a.$$

Hence,

$$a + S(b) = S(b) + a.$$

Therefore, by induction,

$$a + b = b + a$$

for all $a, b \in \mathbb{N}$.

Educational Implication

The commutative property implies that children need to learn only one form of each addition fact. For example, once $3 + 5$ is mastered, $5 + 3$ follows automatically. For slow learners, emphasizing this symmetry significantly reduces memory load and accelerates fact acquisition.

4.2. Associativity of Addition**Theorem 4.2 (Associativity of Addition)**

For all $a, b, c \in \mathbb{N}$,

$$(a + b) + c = a + (b + c).$$

Proof

We proceed by induction on c .

Base case:

For $c = 0$,

$$(a + b) + 0 = a + b = a + (b + 0).$$

Inductive step:

Assume

$$(a + b) + c = a + (b + c).$$

Then,

$$(a + b) + S(c) = S((a + b) + c) = S(a + (b + c)) = a + (b + S(c)).$$

Thus,

$$(a + b) + S(c) = a + (b + S(c)).$$

Hence, associativity holds for all natural numbers.

Educational Implication

Associativity allows regrouping of numbers to simplify calculations. For example,

$$(2 + 8) + 5 = 2 + (8 + 5) = 2 + 13 = 15.$$

Such regrouping strategies are especially valuable for slow learners, as they promote flexible thinking and reduce dependence on counting.

4.3. Multiplication as Repeated Addition**Definition**

For $a, b \in \mathbb{N}$, multiplication is defined as repeated addition:

$$a \times b = a + \underbrace{a + \cdots + a}_{b \text{ times}}.$$

This definition establishes multiplication as an extension of addition and provides a concrete basis for understanding products.

Example 4.1

$$4 \times 3 = 4 + 4 + 4 = 12.$$

In instructional settings, representing this operation through physical grouping of objects (such as stones, blocks, or counters) helps slow learners visualize equal groups and internalize the meaning of multiplication.

4.4. Distributive Law

Theorem 4.3 (Distributive Property of Multiplication over Addition)

For all $a, b, c \in \mathbb{N}$,

$$a(b + c) = ab + ac.$$

Proof

Using the definition of multiplication as repeated addition:

$$a(b + c) = \underbrace{a + a + \cdots + a}_{b+c}.$$

This sum can be separated into two parts:

$$\underbrace{a + \cdots + a}_b + \underbrace{a + \cdots + a}_c = ab + ac.$$

Hence,

$$a(b + c) = ab + ac.$$

Educational Implication

The distributive law enables decomposition strategies that simplify complex products. For example,

$$7 \times 8 = 7(5 + 3) = 7 \times 5 + 7 \times 3 = 35 + 21 = 56.$$

Such strategies are particularly effective for slow learners, as they transform difficult calculations into smaller, manageable components.

5. TYPICAL DIFFICULTIES AMONG SLOW LEARNERS

Slow learner children are faced with a complex of problems, some of which are cognitive and others emotional in character and which is greatly manifested in their capacity to master basic mathematical facts. Not only do these barriers impact the accuracy of computations but they also prevent the development of automaticity, compelling the learner to adopt inefficient methods of doing calculations, like counting fingers or counting through repeat counting.

One of the major limitations that have an impact on mathematical learning is weak working memory. Working memory helps the learners to store and manipulate numerical information temporarily in solving a problem. Students with low learning speeds do not always memorize intermediate operations during calculations and therefore make mistakes in the multi-step calculations. As an illustration, in $8+7$ the child might experience forgetting some of the results in the process of attaining the end result. The low capacity of working memory consequently interferes with mental computation and decreases the general fluency.

Bad sense of numbers also adds to such challenges. Number sense is an intuitive knowledge of quantities and magnitudes and the relationship among numbers. Slow learners often have difficulties with estimating values, identifying numerical patterns and part whole relationships. Such insufficient numerical intuition makes their capacity to use the strategies of flexibility like decomposition or compensation necessary to the processing of arithmetic effectively.

The other major obstacle is abstract symbol difficulty. Mathematical notation is based on the use of such symbols as $+$, $-$, $\times$ and $\div$, which do not represent physical entities, but symbolize abstract operations. Slow learners are usually unable to relate these symbols to the underlying meanings, thus they can mechanically compute them without having an idea. This abstraction gap renders the translation of knowledge between concrete experiences and symbolic representations quite difficult.

Another important factor is slow speed of retrieval. In cases where arithmetic facts are learned, they might take a long time before the slow learners can recall them in the long-term memory. This slow retrieval interrupts the process of problem-solving and adds cognitive load to it, leading learners to forego mental strategies and resort to counting. This pattern does not allow developing the automaticity and supports relying on the labour-intensive methods in the long run.

Besides cognitive elements, mathematics anxiety has a strong impact on performance. The recurring feelings of struggling to succeed and failure may lead to the development of fear and avoidance of mathematics. Anxiety also disrupts the operations of working memory as well as impairs concentration thus deteriorating arithmetic performance. This emotional filter can be a negative feedback loop whereby, the lack of performance causes anxiety, which subsequently leads to the worsening of learning problems.

6. INSTRUCTIONAL EXAMPLES AND SOLUTION STRATEGIES

In order to bridge the gap between theory and practice by applying the theoretical concepts in the real classroom setting, this section will provide a representative example of the four basic arithmetic operations. These worked examples illustrate systematic solution approaches that are based on decomposition, regrouping as well as algebraic properties like distributivity. Step-by-step procedures and visual interpretations are important to close the gap between conceptual and procedural fluency in the case of slow learner children. The examples are carefully chosen to illustrate effective methods of mental computation, facilitate mental load and think flexibly. These examples are instructional examples by focusing on important strategies, not on memorised calculation, and thus helping to acquire mastery of the basic mathematical facts gradually.

Example 6.1 (Addition)

Compute:

$$8 + 5.$$

Solution (Decomposition Method):

$$8 + 5 = 8 + 2 + 3 = 10 + 3 = 13.$$

This “make-ten” strategy improves efficiency.

Example 6.2 (Subtraction)

$$14 - 6.$$

Solution:

$$14 - 6 = (10 - 6) + 4 = 4 + 4 = 8.$$

Example 6.3 (Multiplication)

$$6 \times 7.$$

Using distributive law:

$$6(5 + 2) = 30 + 12 = 42.$$

Example 6.4 (Division)

$$12 \div 3.$$

Interpretation: Partition 12 objects into 3 equal groups.

Each group contains:

$$12/3 = 4.$$

7. CONCLUSION

The research determined that the learning of the basic mathematical facts by slow learner children could be dramatically enhanced by instruction that was strongly based on mathematical theory and supported by the encouraging pedagogical action. Through explicit instruction in algebraic properties, including commutativity, associativity, distributivity, and visual representations, concrete models, and systematized practice, teachers can ease cognitive load and encourage flexible, concept-directed computation. Even though slow learners are burdened by continuous difficulties such as poor working memory, poor number sense, slow retrieval, and mathematics anxiety, these limitations can be overcome with well-structured and learner-centered strategies that establish a balance between conceptual and procedural fluency. The results highlight that arithmetic skills cannot be obtained by practicing rote learning but by having significant interests in counting relationships. This combined system converts the individual facts into understandable networks of knowledge, which builds a sense of confidence, effectiveness, and sustainable mathematical ability. The future studies must provide empirical confirmation of these theoretical implications in the form of classroom interventions and longitudinal studies and add to the evidence-based approaches to inclusive mathematics education.

REFERENCES

1. Abdul-Rahman, M. A. M. M. (2020). *Effectiveness of learner control and program control strategies in developing mathematical thinking for slow learners in mathematics. International Journal of Innovation, Creativity and Change*, 13(1), 897-914.
2. Aprinastuti, C., Anggadewi, B. E. T., Suharno, R., & Wiyantari, W. (2020, October). *Development of mathematics manipulative for slow learner and dyscalculia student in elementary school by using Montessori's characteristic. In Journal of Physics: Conference Series (Vol. 1663, No. 1, p. 012065). IOP Publishing.*
3. Azzahra, N., & Herman, T. (2022, December). *Cognitive ability characteristic and learning motivation on slow learners student in solving mathematics problem. In AIP Conference Proceedings (Vol. 2468, No. 1, p. 070027). AIP Publishing LLC.*
4. Faradillah, A., & Fadhilah, Y. H. R. (2021). *Mathematical problem-solving on slow learners based on their mathematical resilience. Jurnal Elemen*, 7(2), 351-365.
5. Farooq, M. S., & Aslam, S. (2017). *Supporting slow learners' in learning mathematics at primary school level. Journal of Elementary Education*, 27(2), 99-114.
6. Griffin, K. J. M. (1982). *The effects of fingermath, or chisanbop upon the mathematical computational ability and mathematical attitudes of ninth grade general mathematics slow learners with attention given to the variables of sex and learning styles. Northwestern State University of Louisiana.*
7. Khaira, U., & Herman, T. (2020, April). *Assessment processes for slow learners in mathematics learning. In Journal of Physics: Conference Series (Vol. 1521, No. 3, p. 032097). IOP Publishing.*
8. Kumari, A., Vyas, C., & Vidyapeeth, B. (2020). *Challenges Faced by Slow Learners in Mathematics at Primary Level of Education.*
9. Listiawati, N., Sabon, S. S., Wibowo, S., & Riyanto, B. (2023). *Analysis of Implementing Realistic Mathematics Education Principles to Enhance Mathematics Competence of Slow Learner Students. Journal on Mathematics Education*, 14(4), 683-700.
10. Murdiyanto, T., Wijayanti, D. A., & Sovia, A. (2023). *Identify Slow Learners in Math: Case Study in Rural Schools. Int. J. Interact. Mob. Technol.*, 17(6), 45-61.
11. Rajkumar, R., Hema, G., & Harikrishnan, M. (2017). *Teaching slow learners in mathematics: Innovative technologies and strategies. In Education for Slow Learners. Paper presented at the International Conference on Education for Slow Learners organized by Department of Education, Annamalai University, Annamalainagar (p. 120).*

12. Sintawati, M., Sukma, H. H., & Marini, A. (2022, July). *Mathematics pedagogical knowledge for slow learners teaching. In AIP Conference Proceedings (Vol. 2577, No. 1, p. 020061). AIP Publishing LLC.*