



# EFFECTIVENESS OF MENTAL MATH STRATEGY IN TEACHING MATHEMATICS TO GRADE 1 LEARNERS

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## **Abstract:**

The research findings unveil significant insights into the effectiveness of a mental math strategy in enhancing the mathematical performance of grade 1 learners. Initially, both control and experimental groups exhibited satisfactory performance attributed to foundational knowledge acquired in kindergarten and initial grade 1 lessons on addition and subtraction. Following the implementation of the mental math strategy, the control group maintained their satisfactory performance, while the experimental group showed remarkable improvement, highlighting the efficacy of instructional materials and drills associated with mental math. Moreover, techniques such as counting up or back and the use of number lines proved effective in augmenting students' mathematical abilities. Based on these findings, several recommendations are proposed. Firstly, schools and educators are urged to continue enriching students' understanding of whole number concepts using diverse instructional materials and technological resources. Secondly, teachers are encouraged to integrate mental math strategies into their teaching practices, leveraging various learning aids and visual tools to facilitate comprehension. Additionally, both educators and parents are advised to employ counting techniques and number lines through interactive methods such as games and drills to enhance math learning outcomes. Lastly, collaborative learning environments should be fostered, allowing students to engage in problem-solving tasks together, thereby promoting teamwork and peer support while utilizing different mental math strategies. The study's Design and Methodology section provides a comprehensive outline of the research approach, including data collection tools and ethical considerations, employing a descriptive quantitative method to evaluate the efficacy of the mental math strategy in teaching addition.

**Keywords:** Mental math strategy, Grade 1 learners, Mathematical performance, Instructional materials, Number line technique

## INTRODUCTION

When children are first introduced to the ideas of addition and subtraction, they are typically instructed to "count on their fingers" and to use objects to do addition and subtraction operations. But what happens when kids must add and subtract at a faster rate than normal, or when the quantity that has to be added or subtracted requires more fingers than they have? Students need to have mental procedures that they can call upon to solve addition and subtraction problems so that they are not forced to rely on an external tool (i.e., their fingers) to compute addition and subtraction equations. This will allow them to fully master addition and subtraction, as well as to feel confident and capable. They frequently fall behind the rest of the class because they are unable to complete the calculations in their heads, sometimes known as "mental math." This research study explores one teaching technique for mental math that will improve students' addition and subtraction skills and will also help students feel more confident when adding and subtracting. (Riccomini, P. J., Witzel, B. S., & Wang, C. (2009). The modern world would not exist without numbers. Humans rely on numbers for a wide variety of tasks, including reading clocks, measuring objects, making phone calls, and more.

Everyone has been presented with information that required organization before it could be used effectively in decision-making (Bethany Schuster, 2021). Math gives us order and keeps things from getting out of hand. Math helps develop reasoning skills, imagination, abstract or spatial thinking, critical thinking, the ability to solve problems, and even the ability to communicate well. (The Times of India/Guwahati News, 2015). Mathematics is present in all aspects of life, from the most fundamental everyday activities to the most complicated challenges. Furthermore, mathematics is one of the few subjects that is useful at any stage or age. That's why its relevance goes far beyond the limits of the classroom and the university. Because of this, mathematics is a field that calls for a deep and thorough education. Although mathematics might be a challenging subject for primary school children to understand, the abstract nature of the notion frequently makes it difficult to explain mathematics to young students. However, it is much easier to teach students core operating skills when you have access to a variety of instructional materials and strategies. Tools like these help students better understand the connections between mathematics and the real world. Teaching strategies for mathematics like mental math methods can help pupils master the subject and become proficient problem solvers.

One way for children to be proficient problem solver is engaged them in different mental math strategies or techniques that help them build strong mathematical foundation. This study examines the effectiveness of mental math strategy in teaching mathematics to grade 1 learner. Children must have a solid understanding of the operations in order to retrieve and use this information accurately and swiftly when necessary. Every day, we face a diversity of situations that require the application of the four operational skills. The four mathematical operations of addition, subtraction, division, and multiplication are typically performed using one of the following four distinct methods: technological means, written calculations, evaluation of mathematical values, or mental calculations. According to Van De Walle et al. (2016),

estimation and mental computation are favored over other methodologies. Beginning in the early years of schooling, students begin to convert their mathematical knowledge into practical skills that can be applied to everyday problems (Baykul, 2009).

Mental computation is the process of working on a problem in your head and getting the exact or close results without using paper, a calculator, or anything else. Children should learn mental computation, but developing mental computation strategies should not be the sole focus of instruction (Jordan, Glutting, Ramineni, & Heirdsfield, 2010; Heirdsfield, 2011). The focus should instead be on assisting children develop higher order thinking, reasoning, and critiquing skills, as well as the ability to make sense of numbers and number operations (Carvalho and da Ponte 2013; Erdem and Gurbuz 2015; Erdem, Gurbuz, and Duran 2011). If children can learn to do math in their minds, they will be able to complete routine tasks quickly, accurately, and without difficulty. According to Olkun and Toluk Ucar (2018), the primary objective of mathematics education is to equip students with a few critical skills that will enable them to learn rather than simply take in information.

**Mental Calculation and Mathematical Reasoning.** Several principles are crucial in the development of the four operational abilities. Crucially, these capabilities are founded upon sophisticated numerical abilities. Furthermore, the incorporation of numerical structures (such as pattern clusters, increments or decrements of 1 or 2, with consideration of 5 and 10) into the acquisition of numerical concepts, seems to be highly advantageous in fostering the growth of both number sense and mental operation strategies in children. The primary objective is to execute a variety of distinct procedures and ascertain the most effective one for the children. Consequently, the teacher should introduce a range of tactics and thereafter focus on the ones that the pupils see as most efficient. Acquiring information is essential for individuals to effectively implement initiatives. The teacher ought to demonstrate patience towards the pupils and grant them the opportunity to experiment with various methodologies in all four mathematical operations. Additionally, the teacher should encourage the students to find even more distinct strategies, which will enable meaningful learning. According to Tertemiz (2017), during in-class practice, students should make the most of the opportunity to discover patterns and connections.

**Mental Addition Strategies.** According to Liu et al. (2019), the first operation that should be tackled is "addition" because it serves to teach and supports the other three operations. For example, the skills of multiplication are acquired through iterative application of addition, but the skill of subtraction is acquired through identification of the unknown addend. Imbo et al. (2007) and Arnaud et al. (2008) found that pupils' ability to add was influenced by their problem-solving experiences, working memory capacity, age, and amount of schema automation. Addition functions as a fundamental basis for the other operations. This demonstrates that individuals who are significantly impacted by these variables exhibit persistently inferior mental addition strategies, whereas those who are favourably influenced possess the capacity to cultivate a range of varied techniques. A 2007 study conducted at the University of California at Irvine revealed that possessing a solid mathematical background at kindergarten can have a lasting impact on an individual's mathematical abilities throughout their lifetime. Acquiring proficiency

in addition throughout kindergarten might serve as the initial stage in cultivating a lasting passion for mathematics. Most children acquire the skill of addition as their initial mathematical competence, which serves as the foundation for progressing towards mastery of subtraction. Counting is generally the initial basic mathematics skill that young children develop; however, kindergarteners may not grasp the concept that numbers symbolize quantities and are interconnected with other numbers when they first enter the school. Addition is a fundamental mathematical operation that helps children develop a strong understanding of the connections between numbers and how quantities are interrelated. Although kindergartners may not possess the ability to consistently solve addition problems or work with large numbers, acquiring a strong basis in addition equips them with a structure to flourish in mathematics during their elementary school years.

Olsen, 1968, defines subtraction as “separating a group of objects from larger group of similar objects” (p.56) However, generally in Mathematics we think of subtraction in terms of addition, where 6 take away 2 is the answer to the question; what number added to two is 6? (Willending, 1966). There is a clear relationship between the two, addition and subtraction and this connection should be taught to students to enhance their understanding of both (Reys, et al., 2012).

Subtraction is a part of our everyday lives and therefore an important concept to develop early. We need to understand how to subtract in order to engage with society effectively as we use subtraction when dealing with money, travel and time, among countless other daily experiences.

Reys, et al., 2012 explores the notion that subtraction, along with other basic mathematics such as addition, provides a foundation for all later work with computation, only adding to its necessity and making it a vital part of the primary curriculum.

Also, the Australian Curriculum Assessment and Reporting Authority (ACARA) recognizes the importance of teaching children to subtract is one of the first mathematical tasks taught in schools and constitutes a sizeable focus of mathematics instruction in the primary grades (Gutstein & Romberg, 1995). By year two students are required a variety of efficient mental and written strategies as well as recognize the relationship between addition and subtraction (ACARA, 2013).

Children learn addition and subtraction initially. This doesn't happen immediately. Addition and subtraction usually develop between kindergarten and fourth grade. Learning addition and subtraction starts with counting.

Some children don't learn to count until preschool or childcare. However, children may not be proficient in addition and subtraction by that age. First-graders add single-digit and double-digit integers. They also subtract single-digit and tens integers. Second graders' addition and subtraction work gets harder. They learn "borrowing." or regrouping. If a youngster enters fourth grade without being able to add and subtract without objects or drawings, there may not be an issue. Children mature at different rates. It's crucial to determine why they're struggling and falling behind. Introducing children to several ways of solving math problems is vital to their math development.

Practicing mental math strategy is an effective way for students to hone their mathematical abilities. Mental math strategies consist of utilizing known numerical values to solve problems involving more complex mathematical procedures. Numerical facts are numerical relationships that we have learned to memorize and that vary from individual to individual. Children who develop higher order thinking skills, such as reasoning, critiquing, and making meaning of numbers and arithmetic operations, benefit from the development of mental computation strategies. Learning to do math in one's mind would benefit students not only academically, but also professionally and personally.

Mental math allows people to do math "in their heads" without paper or a calculator (Hodnett). Mental arithmetic helps kids understand math, and consistent practice increases number sense. A study on mental arithmetic and mathematical reasoning found that children understood number patterns and numerical relationships. Students strengthened their problem-solving and communication skills as they learned. As they gained expertise and participated more in math, pupils' reasoning and argumentation improved. Mental math practice keeps you sharp. Like exercising muscles, exercising the mind strengthens and improves performance. Why are mental arithmetic strategies important? Mental math computations underpin most number-based subfields of mathematics. Without effective mental strategies, youngsters may struggle to calculate quickly. Mental techniques are both the foundation and the procedure for any written or formal mathematical technique. Even though it's called "mental math" you can write something down, it should be brief jottings to help you remember multi-step problems. Math fluency and accuracy depend on a child's ability to compute in their head, especially after fourth grade, when pupils utilize more formal procedures and work with larger numbers. Children need good mental methods to become "really" fluent. Children acquire true mathematical fluency when they can confidently calculate and solve problems utilizing number relationships, facts, and our number system. Remember that mathematical mastery goes beyond recalling previously taught material. How children use and apply these skills, especially using mental arithmetic procedures, is more important.

Number sense is essential in helping kids learn to do mental math. Students arrive at kindergarten and elementary school with a wide range of experiences, perspectives, and assumptions about numbers. These feelings, thoughts, and knowledge can develop, and deepen through time through formal education or life experiences (Barrera-Mora & Reyes-Rodriguez, 2019). What exactly is this "number sense"? Number sense is a person's general grasp of numbers and operations, along with the ability and the desire to use this information in flexible ways to make mathematical judgments and to build effective and efficient methods for handling numerical circumstances. It also refers to a person's broad understanding of numbers and operations, along with the ability and the inclination to utilize this understanding in flexible ways (McIntosh et al., 1999; Reys and Yang, 1998). A person's ability to comprehend, relate, and link numbers, as well as their capacity to envision and converse easily about numbers, mentally compute, disassemble and reassemble numbers in a variety of different ways, and relate numbers to real-life problems by relating them to their everyday reality is referred to as number sense (Hogan & Hogan, 2017).

Furthermore, Number sense is crucial for young math students because it fosters confidence and promotes adaptable thought. A person's number sense, or their capacity to perceive the relationships between numbers, can also be significantly improved via the practice of mental math. In mathematics education, the development number sense is of critical importance. In their Principles and Standards for School Mathematics, the National Council of Teachers of Mathematics identifies number sense as one of the foundational ideas in mathematics, requiring that students: (1) Understand number, ways of representing numbers, relationships among numbers, and number system; (2) Understand meanings of operations and how they are related; and (3) Compute fluently and make reasonable estimates (NCTM, 2000).

The Commission on Standards for School Mathematics of the National Council of Teachers of Mathematics (NCTM) defined children with number sense in 1987 as those who understand the meaning of numbers, develop multiple relationships among numbers, know the relative sizes of numbers, and comprehend how arithmetic operations affect results (Howden, 1989). Informal knowledge of numbers and quantity plays a crucial role in the development of a child's numerical sense of scale. It is essential that students have opportunities to solve problems that expand upon their existing knowledge. Greeno (1991) defined number sense as mental processing flexibility, numerical estimations, and qualitative evaluations. He did so by referencing how number sense manifests itself in people's daily lives. His understanding of number sense encompassed the role of equivalence in the decomposition and restructuring of numbers, the use of approximate numerical values in computer contexts, and the formulation of inferences and judgments regarding quantities with numerical values. Equivalence specifically played a role in the decomposition and restructuring of numbers. Logic dictates that students who have more opportunities to learn and experiment with mathematics will likely develop a stronger number sense. NCTM Curriculum and Evaluation Standards (1989) provide the definition for Journal of Case Studies in Education. Children with a strong sense of numbers able to: (1) understand the meaning of numbers; (2) develop multiple relationships among numbers; (3) recognize the relative magnitude of numbers; (4) comprehend the relative effect of operations on numbers; and (5) develop a measure for common objects and situations in their environment.

According to the findings of international school performance studies such as the Programme for International Student Assessment (PISA; Organisation for Economic Co-operation and Development (OECD), 2018), the ability to perform basic arithmetic computations in one's head is a prerequisite for the acquisition of mathematical literacy. In addition, the

Mathematics skills outlined in the primary curriculum guides are crucial to their daily existence. For example, learning to add and subtract with multiple digits in one's mind is a worldwide primary school learning objective. According to the primary school mathematics curricula of all federal states in Germany or the United States (e.g., KMK, 2005; NCTM, 2022), students should have developed substantial conceptual addition and subtraction skills in the number range up to 100 by the end of grade two. To achieve these objectives, mental math instruction should begin in grade 1. Based on the curriculum approach, students in grades 1-2 must have a thorough understanding of mental addition and subtraction with two- to three-digit numbers. After third grade, it is expected that students will be able to apply their mental math

abilities to larger number ranges. Prior research (e.g., Bryant et al., 2008; Karantzis, 2011) indicates that the mental addition and subtraction performance of some students is poor even at higher grade levels, indicating an urgent need for educational interventions to address this issue. Different task characteristics that contribute to task difficulty (e.g., Benz, 2003, 2005) and the use of ineffective problem-solving strategies (e.g., Beishuizen, 1993; Cooper et al., 1996; Beishuizen et al., 1997; Heirdsfield and Cooper, 2004; Varol and Farran, 2007) account for poor performance in this area in primary school.

In the United States of America, In 2022, the average mathematics score decreased in 23 of 26 districts, spanning from a decrease of 4 to 15 points. The average score for large city institutions on the National Assessment of Educational Progress (NAEP) decreased by 8 points in comparison to 2019. It is the most comprehensive, nationally representative, ongoing assessment of the state of education in the United States. Since 1969, it has served as a national indicator of student achievement. Moreover, according to the Program for International Student Assessment (PISA)(Kelly et al., 2013), American students in 2015 underperformed a significant international benchmark. The reading and science proficiency of American pupils remained stagnant, while their math performance declined (Hossain, 2012).

In Asia, mathematics is regarded as one of the most important subjects, and students are strongly encouraged to study it (Leatham & Peterson, 2010; Ronis, 2008). Accordingly, in the majority of Asian nations, governing practices for children's mathematics accomplishments are considerably more rigorous (Wei & Dzung, 2014). According to Etcuban and Pantinople (2018), demonstrating acquired a desirable shift in the manner of learning.

In the Philippines, mathematics is a general education subject in primary and higher education where learners are expected to gain understanding and appreciation of its principles as an applied-using appropriate technology in problem-solving, critical thinking, communicating, reasoning, making connections, representations, and decisions in real life (K to 12 Basic Education Curriculum).

In a study conducted by a research institution in the Netherlands, fourth-grade Filipino students scored the lowest in mathematics and science out of 58 countries. According to the 2019 Trends in International Mathematics and Science Study (TIMSS) by the International Association for the Evaluation of Educational Achievement (IEA), the Philippines scored 297 in mathematics and 249 in science. According to the study, both scores are lower than the country's performance in 2003, which was 358 in math and 332 in science. In a study conducted by a research institution in the Netherlands, fourth-grade Filipino students scored the lowest in mathematics and science out of 58 countries. According to the 2019 Trends in International Mathematics and Science Study (TIMSS) by the International Association for the Evaluation of Educational Achievement (IEA), the Philippines scored 297 in mathematics and 249 in science. According to the study, both scores are lower than the country's performance in 2003, which was 358 in math and 332 in science.

In a different study that was conducted locally titled "Computation Skills and Comprehension Skills in Solving Word Problems" concluded that the most useful approaches in teaching problem solving in mathematics in the elementary grades involves instructional

materials (using a model, drawing pictures, finding patterns) and not on the actual problem-solving process itself (divide and conquer, guess and check). This implies that teacher should use varied techniques in teaching mathematics to elementary learners especially in the primary level.

The researcher is prompted to study the effectiveness of mental math strategy in teaching mathematics because of scarcity of data on this research. Since teaching mathematics to primary learners is challenging and exciting. To meet the goal of education in heightening literacy among children as early as primary level, this need shall be addressed. Thus, this study will have the following benefits: First, it will give support to the Department of Education's advocacy which is to heighten numeracy as early as K-3. Second, it will serve as an intervention technique of the school to address learning gaps in mathematics especially in addition and subtraction skills. Other cluster school may be benefited with this study by issuance of use by the school's school head. Third, teachers may adapt and implement the strategies to address learners with difficulties in mastering the concept of addition and subtraction. Further, teachers in grade 1 may produce a self-learning module (SLMs), activities and innovate learning materials/ manipulative materials using the four activities under mental math.

Lastly, this study especially benefits and contributes to the capacitating of grade 1 learners in the mastery and use of addition and subtraction skills boosting their confidence in Mathematics. Also, parents too may implement this in giving follow up activities to help and enhance their child's skills in addition and subtraction.

## REVIEW OF RELATED LITERATURES

Mental math refers to the ability to perform mathematical calculations in one's mind without the use of external tools such as pen and paper or a calculator. This skill involves mental processes such as estimation, logical reasoning, and memory to arrive at solutions quickly and accurately. (Flaherty, Jennifer). Mental math can be a useful skill in everyday life, allowing individuals to make quick calculations without relying on external devices. It can also improve mathematical fluency and problem-solving abilities, as it requires the individual to understand mathematical concepts and apply them in real-time situations. (Flaherty, Jennifer).

The study is anchored on the concept of Piaget's developmental constructivism held that children learn numbers by building them from the inside out. He noted that every normal learner may use good mathematical reasoning if attention and care are given to activities of his interest and emotional inhibitions that often make him feel inferior in math sessions are removed. The learner must challenge and change outdated rules that no longer work (Piaget, 1968).

Further, it will also focus on the following mental math strategy such as the count-back method, use of number line, use of number chart and the doubles and near doubles technique in addition and subtraction. In which according to Reys et al (2012), the count-back method is one of the simplest methods for learning subtraction. There are numerous everyday applications for subtraction, such as calculating the amount remaining after purchasing or the number of candies left in a bag after eating some. It is applicable for both addition and subtraction. When

employing the counting back or even up strategy, it is essential to keep in mind that subtraction refers to the distance between the minuend and subtrahend values. When students comprehend the relationship between the values and the fact that they can count backwards from the minuend or count upwards from the subtrahend, their understanding of number sense and how numbers interact is enhanced. With increasing values, this strategy can be coupled with a number line or an open number line. This is the ideal method for introducing addition and subtraction to pupils without using formal mathematical terms such as "plus" and "minus." By employing this strategy, children become aware of counting up or down from the larger number, beginning with the larger number. As familiarity increases, formal language can be introduced (Reys et al., 2012).

A counting up technique study found that meaningful education can help children employ an alternative strategy to solve subtraction problems. Counting or counting back procedures are vital for youngsters learning to count. Most children utilize counting procedures to solve numerical issues (Clark, et al., 2002, p.1). Up or back strategy or counting? Teachers can utilize counting up or back to teach early addition and subtraction. Students start with the highest number in the equation and count up the number of times the lowest number. The counting back approach starts with the highest number in the equation and works backwards the number of times the lowest number demands (Reys, et al. 2012). This method uses blocks and number lines to count up and back. The quantity of the known number name sequence and the capacity to count reliably limit counting's power (Clark, et al., 2002). Students must comprehend the order of numbers travelling forward and backward to count. Children can utilize manipulating items to understand this method before doing mental calculations. Concrete learning is possible with hands-on counting up and back (Reys, et al. 2012). Once kids understand counting up and back, they can move away from manipulatives and practice mental math calculations. (Gray, 2011) 'Counting is not only an everyday survival skill' but also the foundation for growth of math skills (Clark et al., 2002)

In early years education, "counting forwards and backwards by ones from various starting points presents a barrier but, once overcome, students move readily to the subsequent point" (Clark, et al., 2002). The fact that once this skill is grasped, children's learning will flow more freely shows its value to students. Given these and the other reasons, teaching counting up and counting back procedures is crucial for scaffolding children's arithmetic learning.

Mathematics is varied. Its ubiquitous applicability makes it useful in many domains, especially for tackling real-world problems. Students must be mathematically adept and critical thinkers to solve such situations. Understanding what pupils know and need to learn and challenging and encouraging them to study math effectively. Understanding mathematics, students, and pedagogy is also needed (NCTM, 2000). Constructivist concepts of knowledge, learning, and teaching underpin NCTM's teaching approaches. Constructivist mathematics teaching helps students go beyond rote memorization, create meaningful settings, and take

responsibility of their learning (WGU, 2020). These constructivist ideas emphasize active learning, cognitive development in social interaction, and conceptual comprehension in mathematical instruction.

According to Piaget's theory of cognitive development (1977), all knowledge is produced, and the instrument of instruction contains cognitive structures that are always being built. Piaget says that primary school students require concrete objects, pictures, movements, and symbols to learn math at the preoperational stage. Bruner also believes that conceptual learning begins with active engagement or experiences with concrete tasks ('enactive'), next perceptual images ('iconic'), and last abstract ('symbolic') representations (Bruner, 1966). When teaching addition with regrouping for  $8 + 6$ , Grade 1 students should move blocks in two groups to demonstrate using part of one addend to make the other a complete "ten." The hands-on technique treats numbers as quantities and moves on to pictorial depiction of the same problem type. Learners visualize and manipulate abstract problems as they progress. According to the Concrete-Representational-Abstract (CRA) Model, mathematics education should lead students to abstract symbol representations and operations (Hui et al., 2017). However, Vygotsky (1978) argues that an individual cannot develop without environmental interaction in his zone of proximal development. Teachers can create strategic educational programs for groups or individuals at different developmental stages using this notion. Teachers can scaffold learning via purposeful social interactions, specialized learning experiences, and instructions that match a learner's prior performance, intuition, and present thought processes by connecting complex information to familiar concepts. This helps learners understand new situations, build on past knowledge, and transfer learning. These strategic educational methods for math employ manipulatives, games, models, partial solutions, and contextual problems based on student interest. Cognitive behavior and the mind are central to cognitivism. Students' mental processes underlie their actions (Pandey, 2017). Anderson et al. (1995) state that information, expectations, sentiments, and interactions with others and the environment affect how and what one learns.

According to Glasersfeld (1987), knowledge is self-organized and built by the cognizer. This implies that all knowledge is manufactured rather than sensed. For instance, mastering multiplication requires understanding the concepts behind the facts. Without basic notions, students struggle with higher-order thinking. Mathematical representations show students' thinking. They assess the situation, construct a concept, and extend their reasoning with these representations, whether concrete or abstract. Students should create and use representations to organize, record, and communicate mathematical ideas; select, apply, and translate mathematical representations to solve problems; and model and interpret physical, social, and mathematical phenomena, according to NCTM Standards (2000) (Fennell & Rowan, 2001)(Grades 1–7 Matatag Mathematics Curriculum).

Within the general tradition of the assumption of teaching for profound understanding, there is a large body of research coming from two different theoretical perspectives: 1) the

psychological perspective which focuses on the development of mathematical concepts within the individual (Davis, Maher, & Noddings, 1990b; Ernest, 1996; Fosnot, 1996; Kamii & DeClark, 1985; Steffe & Kieren, 1994; Steffe & Thompson, 2000a; von Glasersfeld, 1991), and 2) the sociocultural (Bishop, 2002; Bliss, Askew, & Macrae, 1996; Crawford, 1996; Forman, 1996; Lave & Wenger, 1991; Lerman, 1996, 2001; Mercer, Wegerif, & Dawes, 1999; Nunes, 1992; Perret-Clermont) in which learning is analyzed from the perspective of the collective classroom community.

This study is also based on the concept that, teaching strategy is the way of teachers in delivering the lessons to students by certain methods corresponding to characteristics of the students that were encountered (Agsisiyo, 2021). According to Djamarah (2010) as cited by Agsisiyo (2021) in her study, the strategies of teaching is a teaching strategy to achieve the expected goal. By utilizing an accurate method, the teacher will achieve the goal of teaching smoothly. Thus, the teachers are encouraged to use strategies or methods that can support teaching and learning activities, so it can be used as an effective tool in enhancing children's mathematical skills.

Mathematics is an effective tool for identifying, describing, and applying patterns and relationships, as well as for generalization and communication. It encourages users' recognition and appreciation of the nature, beauty, and force of mathematical processes, strategies, and reasoning. The successful study of mathematics in Grades 1 through 10 is a crucial component of the preparedness of Filipino students for life in the 21st century. For full participation in society, students must develop the mathematical knowledge, skills, and understanding necessary to make informed decisions and solve problems in a variety of everyday contexts. Historically, mathematics emerged from the need of human civilization, with real-world problems giving rise to its existence and emphasizing problem-solving at its core. In institutions, mathematics is an ideal training ground for developing students' problem-solving skills. Moreover, in this age of scientific and technological advancements, "numeracy" is essential for engaging in a variety of activities. The Organisation for Economic Co-operation and Development (OECD) defines numeracy as "the ability to access, use, interpret, and communicate mathematical information and ideas in order to engage in and manage a variety of adult life situations that require mathematics." "Numeracy, a significant auxiliary to problem solving, pertains to a substantial portion of the mathematics content of the Grades 1 to 10 Mathematics curriculum. Learners become more 'numerate' as they develop the confidence and ability to choose and use mathematics effectively in situations that arise in their family, workplace, and community; and to apply, evaluate, and communicate their mathematical thinking.

To strengthen the country's "international score" especially when it comes to Science, Technology, Engineering, and Mathematics, the DepEd recently launched the MATATAG Curriculum, which aims to decongest the current K to 12 Curriculum and which includes a reduction in the number of competencies and is more focused on the development of

foundational skills such as literacy, numeracy, and socio-emotional skills for kindergarten to Grade 3. According to Duterte, MATATAG will have four critical components: Make the curriculum relevant to produce competent and job-ready, active, and responsible citizens; Take steps to accelerate delivery of basic education facilities and services; Take good care of learners by promoting learner well-being, inclusive education, and a positive learning environment; and Give support to teachers to teach better. The primary objective of the curriculum is to cultivate mathematical proficiency and develop critical problem-solving skills among Filipino learners. The cultivation of mathematical proficiency in learners entails the enhancement of both confidence and skill in various facets of mathematics, while also fostering a growing appreciation for the practicality and significance of mathematics.

According to Polya (1981), issue solving refers to the process of discovering a solution to a challenging situation or overcoming an impediment in order to achieve a goal that was once unattainable. In addition, the National Council of Teachers of Mathematics (NCTM), in their publication in 2000, emphasizes that solving problems is not only an objective of studying mathematics, but also a significant method of achieving that objective. Within the realm of mathematics education, problem solving is regarded as an objective, a systematic approach, and a fundamental proficiency. The processes involved in solving mathematical problems, from recognizing and understanding a problem, to modelling the problem through different representations, to planning a solution, to executing the solution, and to finally checking whether the problem has been solved, demonstrate that problem solving is a very important life skill for 21st-century citizens to possess (MATATAG CURRICULUM MATHEMATICS GRADES 1, 4 and 7).

As per the MATATAG CURRICULUM MATHEMATICS, by the completion of Grade 3, the student exhibits proficiency in the domain of Number and Algebra, encompassing whole numbers up to 10,000; ordinal numbers up to 100th; addition and subtraction of numbers up to 4 digits, as well as money up to ₱10,000; multiplication and division utilizing the 6, 7, 8, and 9 multiplication tables; estimation of products of two numbers; and other related concepts.

The application of this information, skills, and understanding, aided by technology, is utilized in the mathematical processes of critical thinking, problem solving, communication, reasoning, and establishing connections across different fields of study. Nevertheless, issues pertaining to mathematical proficiency persist not only in the Philippines but also in other nations. In today's interconnected world, it is essential for both adults and children to possess a basic understanding of mathematics. Studying mathematics enables us to acquire knowledge about currency and develop the ability to perform basic calculations while making purchases and sales.

Hence, it assumes a crucial function in our day-to-day existence. There is a wide variety of effective methods available for enhancing one's ability in mental mathematics. Several of

them are very cool techniques, such as using counting up or back strategy that are describe beforehand, using number line, using a number chart, and doubles and near doubles technique among other strategies in mental math. This study focuses on particularly on the four strategies of adding and subtracting mentally. Counting back or up is a mental strategy for addition and subtraction. One of the simplest methods for learning subtraction is to use the count back method. By counting backward from the larger number, one can learn subtraction by deducting the smaller number from the larger number using the counting back method. Here, each stage involves the removal of one number. For example: If you consume five out of the thirteen lollipops, how many will be left? Let's count back and deduct 5 from 13. The Count back strategy will help you find out what's left after taking one number away from another. On the other hand, A mental math technique called "count on" is used to add numbers. By starting with the bigger number and "counting on" with the other addends, a pupil can arrive at the sum using this method.

In case the number sentence involves  $4+3$  plus three, the learner will recognize 4 as the greater number and proceed to count on 3 more: "5, 6, 7." Seven is the sum or total. Students must be able to "hold" a number in their minds and subsequently add to it while using the count on math fact. Research shown they're important because they promote good mental arithmetic strategies.

Literature classifies the addition operation into two distinct types: aggregation (finding the sum of two quantities) and augmentation (finding an increased value), whereas subtraction has four distinct structures: partitioning, reduction, comparison, and inverse-addition. The National Council of Teachers of Mathematics recommended pupils to comprehend numbers and operations and apply mental strategies or algorithms to compute efficiently and accurately. No matter their strategy, students should be able to explain it and choose the best one for a collection of numbers. For example, counting back is better for subtraction problems using " $91-6$ " and counting up for determining the difference between " $91-84$ ". The algorithm solves " $67-45$ " well. Thus, we must provide children several opportunities to explore relevant math strategies.

Studies on counting strategies up to 20 showed children's informal methods and number concepts in addition and subtraction. According to other study on counting multi-digit numbers, models and settings assist children learn value concepts and number structure, laying the groundwork for formal procedures like mental arithmetic. Treffers, Buys, and Thompson created three computation levels for addition and subtraction up to 100. Low-level kids count numbers to solve addition and subtraction problems. Next, children structure and use tens-based approaches like splitting and stringing. Children do mental computations or algorithm correctness at the formal level.

Another technique is the use of a number line. Many studies report on the several uses of the number line and its crucial role in mathematics education. The number line is used for

estimation (Onslow, et al., 2005), for multiplication (Fuys & Liebov, 1993; Kastberg, 2005; Wallace, & Gurganus, 2005), for measuring length (Gravemeijer & Stephan, 2002) and time (Moone & Groot, 2005), for extending students' knowledge (Thompson, 2001: 72) and for giving access to possible solution strategies (Dickinson & Eade, 2004: 46). It also allows the representation of numbers (Chazan & Ball, 1999; Wiegel, 1998), as well as the forming of geometric models for the operations of arithmetic (Herbst, 1997: 38; Kilpatrick et al., 2001: 90). The important potential of the number line is that it provides a simple way to picture mathematical concepts. Many mathematical ideas and concepts require increasingly complex language to describe and assess, so a representation like the number line can reduce the text that pupils need to be able to interpret in order to access the mathematics in the question (Blinko, 2004: 3). Apart from that, according to Gravemeijer & Stephan (2002: 151), the number line supports the students' performance on counting-type tasks, by offering a way of scaffolding both partial calculations and partial results. The ways that the number line can be presented are various. It can be structured or semi structured, with or without numbers or other symbols, modeling the mathematical concept/solution. However, another type of number line representation, which is suggested in the literature, is the empty number line. This type of number line offers the student the freedom to use it in his/her own way for jotting or for working (Thompson, 2004), thus applying his/her own solution strategies. A graphic representation of numbers on a straight line is called a number line. On a number line, the numbers are arranged evenly spaced apart throughout the length of the line. It is typically displayed horizontally and can stretch forever in any direction.

When moving from left to right on a number line, the numbers grow, and when moving from right to left, they decrease. You can represent any kind of number, including fractions, decimals, integers, etc., using a number line. Addition and subtraction can also be done with a number line. Steps to add/subtract on a number line: Locate the first number on the number line. To add: move as many steps as the second number to the right. To subtract: move as many steps as the second number to the right. The number you land on is the answer.

Research suggests that visual representations, like a number line, support students' development of number sense by helping them create a mental representation of the order and magnitude of numbers" ((Woods et al., 2017). The third strategy is the use of number chart in addition and subtraction. Using visual tools when learning to perform mathematical operations allows students to draw on these mental models and visualizations to perform mental calculations. The number chart is a great visual tool to build number sense, use skip counting, recognize patterns, and add and subtract. The hundred chart is, as research shows, most powerful when it is presented as one of several representations of numbers and operations. The benefits of the number chart, as compared to other tools and manipulatives, are many. It functions much like a number line, but in a more condensed space that highlights place value and patterns. It allows for more advanced 2-digit operations, which can become cumbersome with manipulatives such

as base-10 blocks. This approach to math promotes critical thinking and conceptual understanding.

Number charts play a vital role in helping students understand the principles of addition and subtraction. These visual representations of numbers provide a foundation for young learners to develop their mathematical skills and gain a deeper understanding of mathematical operations. The use of number charts allows students to visualize numbers and their relationships, making it easier for them to comprehend addition and subtraction. By having a visual aid to refer to, students can more easily see patterns and relationships between numbers, which in turn helps them to solve addition and subtraction problems more effectively. Furthermore, number charts can serve as a tool for students to practice addition and subtraction in a structured and organized manner. By using number charts, students can work through problems systematically, helping them to develop their problem-solving skills and build their confidence in math.

In a study conducted by Sarkar, Debnath, and Ghosh (2020), the researchers found that using visual aids, such as number charts, had a positive impact on students' understanding of addition and subtraction. The study concluded that visual aids were effective in helping students develop a deeper understanding of mathematical concepts and in improving their problem-solving abilities. Overall, number charts are an essential tool in teaching addition and subtraction, as they provide a visual representation of numbers that can help students develop their mathematical skills and problem-solving abilities. By incorporating number charts into math instruction, educators can help students build a strong foundation in mathematics and develop a lifelong love for learning. Lastly, it will also look on doubles and near doubles technique in addition and subtraction. What is a double and near double in addition and subtraction? The doubles and near doubles mental math technique is a strategy used to quickly perform addition and subtraction by recognizing patterns and relationships between numbers. It involves doubling or near-doubling one number and adjusting the operation accordingly to find the sum or difference. Near Double is a math fact that is close to a doubles fact. For example,  $6+7$  is considered a near double because it is close to the doubles fact  $6+6$ .

Near doubles could be doubles plus one facts, doubles plus two facts, or doubles minus one facts. Near doubles are also called the "doubles-plus-one" or "doubles-minus-one" facts. All combinations where one addend is one more than the other are included in this group. The strategy involves adding one after doubling the smaller number or subtracting one after doubling the larger number. For example  $4 + 5$ , start by doubling 4, then add one to 8 to get 9. A student can also start by doubling 5, then subtract one from 10 to get 9. Students must have a command of the doubles strategy before focusing on these facts (Van de Walle, 2007).

Let's take a look at the doubles fact  $5+5$ .  $5+6$  would be the double plus one ( $5+5$  plus one more).  $5+7$  would be the double plus two ( $5+5$  plus two more).  $5+4$  would be the double minus one ( $5+5$  subtract one). We learn that we can connect ideas and create relationships between facts by using the near doubles technique. But we have to be careful not to teach this in a

methodical way that encourages "memorization" of the technique by our students. We can let our pupils explore through the use of manipulatives such as beads and other visual representations.

There are only 10 double facts for students to learn from  $0 + 0$  to  $9 + 9$ . These facts are relatively easy for students to learn and become a powerful anchor for students to learn other facts, such as near double facts. When doubling a number, a student can also count by twos. For example  $8 + 8$  is equivalent to eight twos or 16. This underlies the relationship between even and odd numbers (Van de Walle, 2007). Students will find it easier to use other mental math strategies—especially the near doubles—if they have a solid foundation in doubles. Building relationships and making connections between information is the aim of the near doubles facts. Regularly use manipulatives will help us accomplish this goal. Research has shown that using mental math strategies like doubles and near doubles can help improve students' computational fluency and efficiency. According to a study by Schneider et al. (2021), students who were taught mental math strategies including doubles and near doubles showed significant improvements in their ability to solve addition and subtraction problems quickly and accurately.

## METHODOLOGY

The section on Design and Methodology outlines the research design, locale, population, data gathering tools and procedures, statistical treatment of data, and ethical considerations. Employing a descriptive quantitative method, particularly an experimental pretest/posttest control group design, the study assesses the effectiveness of a mental math strategy in teaching addition and subtraction to thirty grade 1 learners at Cabitin Elementary School. Data were collected through teacher-made tests and DepEd-approved learning modules, with 15 items per activity totaling 60 items for both pretest and posttest. The researcher obtained necessary permissions, including parental consent, and conducted face-to-face testing. Ethical considerations ensured voluntary participation, confidentiality, and result dissemination through appropriate channels. Statistical analyses included descriptive statistics, weighted mean, frequency, and t-tests to determine mastery levels and performance differences. Microsoft Excel's analysis tool pack was utilized for validity.

## DISCUSSION

### **Level of Performance of Learners of the Control Group and Experimental Group in Math in the pretest Before the Use of Mental Math Strategy**

#### **Control Group**

Table 2 illustrates the performance of the control group in the pretest before the use of mental math strategy at Cabitin Elementary School.

Table 2. Level of Performance of Learners of the Control Group in Math in the pretest

Performance Level	Counting or back		Chart		Number line		Double and new double	
	F	%	f	%	f	%	f	%
Outstanding (13 to 15)	1	6.67	4	26.67	1	6.67	3	20.00
VS (10 to 12)	6	40.00	5	33.33	7	46.67	6	40.00
S (7 to 9)	4	26.67	5	33.33	5	33.33	5	33.33
FS (4 to 6)	4	26.67	0	00.00	2	13.33	1	6.67
Did Not Meet Expectations (1 to 3)	0	0.00	0	0.00	0	0.00	0	0.00
Average	8.67		10.86		9.8		10.2	
	Satisfactory		Very Satisfactory		Very Satisfactory		Very Satisfactory	

The data shows that there were differences in the performance levels of students in the control group, across various mental math techniques. The average performance of learners in the control group in math was very satisfactory, with an average score of 8.67 for counting or back, 10.86 for charts, 9.8 for number line, and 10.2 for double and new double. This indicates that there is room for improvement in certain areas, but overall, the students in the control group demonstrated a decent level of understanding of the math concepts assessed. The last three strategies had a very satisfactory descriptive equivalent, while the counting up or back strategy had a satisfactory descriptive equivalent.

As per Department of Education Order No. 73(2012), a very satisfactory performance indicates proficiency. It means that learners at this level developed the fundamental knowledge and skills, core understanding and they can transfer these through authentic performance tasks. One factor that contributed to the performance level of the learners is that they already had their lesson on addition and subtraction before the conduct of the pretest as per their teacher. While a satisfactory performance indicates that students are approaching proficiency and have acquired the necessary knowledge and skills in computational and analytical mathematics and with little guidance from their teachers and or from their peers, they can transfer through authentic performance tasks in which learners in the doubles and near doubles achieved level in the pretest.

Upon further examination of the results, it can be observed that the majority of students fell into the "VS" category, with 40% falling into the range of 10 to 12 for counting or back, 33.33% falling into the range for charts, 46.67% falling into the range for number line, and 40% falling into the range for double and new double. This suggests that a significant portion of learners in the control group had a very satisfactory level of performance in these areas.

It is also worth noting that there were some learners who performed at an outstanding level, particularly in the category of charts where 26.67% of learners scored 13 to 15. This indicates that there are some students in the control group who have a strong understanding and proficiency in math concepts related to charts due to their logical-mathematical intelligence. The number line technique was the most commonly used strategy, with 7 learners scoring 46.67% falling under the rating scale of very satisfactory. This indicates that these learners have acquired the necessary knowledge and skills in addition and subtraction..

Table 3. Level of Performance of learners of the Experimental Group in Math 1 in the pretest

Performance Level	Counting or back		Chart		Number line		Double and new double	
	F	%	f	%	f	%	f	%
Outstanding (13 to 15)	2	13.33	6	40.00	2	13.33	2	13.33
VS (10 to 12)	3	20.00	3	20.00	6	40.00	10	66.67
S (7 to 9)	8	53.33	4	26.67	4	26.67	2	13.33
FS (4 to 6)	2	13.33	2	13.33	3	20.00	1	6.67
Did Not Meet Expectations (1 to 3)	0	0.00	0	0.00	0	0	0	0.00
Average	9.26		10.26		9.73		10.73	
	Satisfactory		Very Satisfactory		Very Satisfactory		Very Satisfactory	

On the other hand, there were a small number of learners (7) who fell into the "FS" category, indicating that they had a fair level of performance in certain areas. However, it is encouraging to see that none of the learners in the control group fell into the "Did Not Meet Expectations" category, suggesting that all students have at least some basic understandings of the math concepts assessed in the different mental math strategy.

Table 3 presents the level of performance of learners of the experimental group in Math 1 in the pretest before the use of mental math strategy at Cabitin Elementary School, Mankayan, Benguet.

The pretest results of the experimental group provided valuable insights into the level of performance of learners into the different mental math strategies. The use of counting up or back technique, chart, number line, and doubles and near doubles were assessed, with varying average scores and descriptive ratings assigned to each. The use of counting up or back technique has an average of 9.26, use chart, 10.26; number line 9.73 and doubles and near doubles, 10.73.

The last three strategies had a very satisfactory descriptive equivalent, while the counting up or back strategy had a satisfactory descriptive equivalent.

As per Department of Education Order No. 73(2012), a very satisfactory performance indicates proficiency. It means that learners at this level developed the fundamental knowledge and skills, core understanding and they can transfer these through authentic performance tasks. While a satisfactory performance indicates that students are approaching proficiency and have acquired the necessary knowledge and skills in computational and analytical mathematics and with little guidance from their teachers and or from their peers, they can transfer through authentic performance tasks in which learners in the doubles and near doubles achieved level in the pretest. One factor that contributed to the performance level of the learners is that they already had their lesson on addition and subtraction before the conduct of the pretest as per their teacher. Further analysis revealed the of the results the four mental math activities as follows:

In terms of counting or backwards counting, 53.33% of learners fell into the 'S' category, indicating a satisfactory level of performance. This suggests that a majority of learners in the group were able to effectively count or count backwards, but there is still room for improvement.

When it comes to using a chart to solve math problems, 40% of learners achieved an 'O' rating, indicating an outstanding level of performance. This suggests that a significant portion of learners were able to effectively use charts to solve math problems, showcasing a strong understanding of the concept.

In terms of using a number line to solve math problems, 40% of learners achieved a 'VS' rating, indicating a very satisfactory level of performance. This suggests that a majority of learners were able to effectively use number lines, but there is still room for improvement in this area.

Finally, in terms of understanding and using double and new double concepts, 66.67% of learners achieved an 'VS' rating, indicating a very satisfactory level of performance. This suggests that a majority of learners were able to effectively apply these concepts in their math problems, showcasing a strong understanding of the material.

The results also shows that most of the learners fell under the rating scale of satisfactory to very satisfactory level. As per the Department of Education, learners at this level have already developed the fundamental knowledge, core and understandings of the concept and can transfer these independently or with a little help of their teachers or peers through an authentic performance task.

While few numbers of learners fell under fairly satisfactory, the use of chart and number line has 3 learners with 20% score, chart and counting up or back with 2 learners each with 13.33% score, doubles and near doubles with 1 learner with 6.67% score with a total of 6 learners indicating that they still needed guidance in understanding addition and subtraction concepts. According to DepEd Order No. 73 (2012), the learner at this level has a minimum knowledge, skills and core understanding but needs help throughout the performance of authentic tasks. This highlighted the importance of tailored instruction and support for learners at different proficiency levels. Teachers play a critical role in providing authentic performance tasks and guidance to help students develop their mathematical skills effectively.

Overall, the average level of performance in the pretest was satisfactory to very satisfactory. This indicates that the learners in the Experimental Group have a good foundational

understanding of the math concepts covered in the pretest, but there is still room for improvement in certain areas such as using number lines and counting or counting backwards. By identifying these areas of weakness, educators can tailor their teaching approach to better address the needs of the learners and help them improve their performance in Math 1.

To further enhance the learners' understanding and performance in Math 1, educators can focus on providing additional practice and reinforcement in these weaker areas. This may include incorporating more hands-on activities, visual aids, and real-world examples to help the learners better grasp these concepts. Additionally, providing personalized instruction and support to individual learners who may be struggling in these areas can also be beneficial.

By addressing these areas of improvement and building upon the learners' existing knowledge and skills, educators can help the learners develop a strong foundation in math and set them up for success in future math courses.

In comparison, the control group, the use of chart with the highest mean score of 10.86 in the very satisfactory level. While in the experimental group, Double and new double exhibited the highest mean average score of 10.73 with a very satisfactory rating scale. On the other hand, both in the control group and experimental group, the use of counting up or back demonstrated the lowest mean average score of 8.67 and 9.26 respectively in the satisfactory level. Also, it is important to note that no learners did meet the expectation performance level. Overall, the average performance levels were slightly higher in the experimental group compared to the controlled group.

The implication of these findings is that pretest are important assessment tools to measure the learners' current level of knowledge, skills and understandings on certain learning content prior to the teaching of the said learning contents or subject matters. According to Hombuckle (2022) pretests are non-graded assessments where the teacher determines each students' knowledge of and proficiency in the tested subject matters. Pretests given at the beginning of the learning content and the pretest results gave the teacher a way to gauge the students' knowledge, prepare the students for future learning content and in the end, measures student's academic growth. Pretests also serves as a way for educators to understand where learning gaps may have formed during the pandemic or breaks in school wherein pretest maybe vital.

As mentioned by Pating (2015), as children get older, they meet situation where they need to combine two different sets of things or split a setup, to count differences and to compare (subtract). For a long time, they need to do their adding and subtracting in a practical way.

In this study pretest was given not only to assess learner's performance on their mathematical computational and analytical skills but also the comprehensiveness and effectiveness of the different mental math techniques.

### **Level of Performance of the Control Group and Experimental Group in Math 1 After the Use of Mental Math Strategy**

The results in the four mental math activities are as follows:

The use of doubles and near doubles technique and chart had the highest number of learners in the Outstanding rating scale, having the same 40.00% percentage score, with a total

of 12 learners achieving this level. While the number line had 5 learners with a percentage score of 33.33%. On the other hand, the double and near double had the highest number of learners in the Very Satisfactory level, with 40% percentage score, with a total number of 6 learners achieving this level. The use of chart and counting up or back technique also fall in the level of Very satisfactory with the same percentage scores of 33.33%. It is also noted that 3 learners falls in the fairly satisfactory level with a percentage score of 13.33% in the use of number line while the use of counting up or back has 1 learner falls into the same level making it the lowest level in the control group post test results. No learners scored in the "Did Not Meet Expectations" level, indicating a decent level of understanding and application of mathematical and analytical skills.

Control Group

Table 4 presents the performance of the control group in Math 1 in the post test after the use of mental math strategy.

Table 4. Level of Performance of the Control Group in Math 1 in the post test

Performance Level	Counting or back		Chart		Number line		Double and new double	
	F	%	F	%	f	%	f	%
Outstanding (13 to 15)	2	13.33	6	40.00	5	33.33	6	40.00
VS (10 to 12)	5	33.33	5	33.33	4	26.67	6	40.00
S (7 to 9)	7	46.67	4	26.67	3	20.00	3	20.00
FS (4 to 6)	1	6.67	0	0.00	3	20.00	0.00	0.00
Did Not Meet Expectations (1 to 3)	0	0.00	0	0.00	0	0.00	0	0.00
Average	9.8		11.4		10.26		10.13	
	Very Satisfactory		Very Satisfactory		Very Satisfactory		Very Satisfactory	

The total average scores for each technique were relatively close, with the use of chart technique having the highest mean average score of 11.4 and the counting up or back strategy having the lowest average score of 9.8. All of the four mental math strategy category falls on the descriptive rating of very satisfactory. A very satisfactory level as per DO No. 8 (2015) is described as approaching proficiency. Learners in this level have developed fundamental knowledge, skills, and core understanding and with the little guidance from their teachers or from their peers, can transfer these understanding through authentic performance tasks.

In summary, the learners in the control group also showed improvement in their performance levels although learners were not introduce to Mental Math strategies after the post-test assessment.

Looking at the results, the doubles and near doubles technique had the highest number of learners in the Outstanding category, with 73.33% average score with a total of 11 learners achieving this level. The counting up or back, and number line falls also in the outstanding performance level with the following percentage scores of 66.67% (10 learners), (9 Learners) and 53.33%(8 learners) respectively except for the use of chart with a score of 60.00% Based on the grading scale provided by the Department of terms of knowledge. Skills, and understandings automatically and flexibly through authentic performance tasks. Also, this indicates that the four mental math strategy were effective for these learners in the experimental group. On the other hand, the number line technique had the highest number of learners in the Very Satisfactory category, with 33.33% percentage score, with a total number of 5 learners achieving this level. A very satisfactory level as per DO No. 73 (2012) is describe as proficient. Learners in this level have developed fundamental knowledge, skills, and core understanding and with the little guidance from their teachers or from their peers, can transfer these understanding through authentic performance tasks. While in the satisfactory level, the use of chart has 4 learners with a percentage score of 26.67%.

#### Experimental Group

Table 5 presents the level performance of learners in the experimental group in Math 1 in the post test after the use of mental math strategy at Cabitin Elementary School, Mankayan, Benguet.

Table 5. Level of Performance of learners of the Experimental Group in Math 1 in the post test

Performance Level	Counting or back		Chart		Number line		Double and new double	
	F	%	f	%	f	%	f	%
Outstanding (13 to 15)	10	66.66	9	60.00	8	53.33	11	73.33
VS (10 to12)	4	26.67	2	13.33	5	33.33	3	20.00
S (7 to9)	1	6.67	4	26.67	2	13.33	1	6.67
FS (4 to 6)	0	0.00		0.00	0	0.00	0	0.00
Did Not Meet Expectations (1 to 3)	0	0.00	0	0.00	0	0	0	0.00
Average	12.8		12.33		12.67		13.13	
	Outstanding		Outstanding		Outstanding		Outstanding	

It is important to note that no learners fell into the level of fairly satisfactory and Did Not Meet Expectations performance rating scale for any of the techniques, which indicates that overall, the learners had a good understanding of the mental strategies being used.

The total average scores for each technique were relatively close, with the doubles and near doubles technique having the highest average score of 13.13 and the use of chart having the

lowest average score of 12.33. This suggests that while the doubles and near doubles technique may have been slightly more effective on average, all of the techniques were generally successful.

Overall, the learners in the experimental group demonstrated significant improvement in their performance levels across all Mental Math strategies, with the highest average performance observed in the Doubles and near doubles technique. The majority of learners achieved outstanding levels in their post-test assessments, indicating the effectiveness of these strategies in enhancing their mathematical skills.

The implication of this findings is that post test is an assessment to increase their performance level as a result of the actual experiences and imparted knowledge and understanding and analytical skills in mathematics.

Hombuckle explains that post test are assessment tools to show whether a student gained the knowledge and skills required to successfully to complete a course or a certain learning content. Post test reveal how much each student's knowledge and skills grew and how students improved after the undertaking the actual lesson of the learning content.

Goeller (2018) agreed that for students to learn and be successful, motivation, engagement, attention, interest, effort, enthusiasm, participation, and involvement are some important attributes that must be impacted.

The administered post test also measured the efficacy of the different mental math strategy in helping learners gain the desired learning outcomes particularly on the mathematical concepts and problems presented to them. Thus the different mental math strategies must also be evaluated in terms of its use, presentation and appeal to the learners.

In conclusion, different learners may have different preferences and strengths when it comes to counting strategies. It is important for educators to recognize this and provide opportunities for learners to use a variety of techniques to support their mathematical development.

This assessment of the learners' performance during the post test is very good considering that they have already received formal lessons on adding and subtracting whole numbers.

### **Difference in the Performance of Learners in the Control Group and Experimental Group in Math 1 in the Pre and Post-test**

#### **Control Group**

Table 6 presents the difference in performance levels of learners of the control group in Math 1 in the post-test.

Table 6. Difference in the Performance of Learners of the Control Group in Math 1 in the Pre and Post tests

Strategies	Pretest	Post Test	p-value	Interpretation @ $\alpha= 0.05$
I. Using counting up or back	8.66	9.8	0.34	Not significant
II. Using a chart	10.86	11.4	0.44	Not significant
III. Number Line	9.8	10.26	0.67	not significant
IV. Double and new Double	10.2	11.93	0.04	significant
Average	9.86	10.86		

In this table, the performance of learners in the control group in Math 1 is compared in the pre and post tests using different mental math strategies.

Using the counting up or back strategy, there was not a significant difference in performance between the pretest (8.66) and post-test (9.8). The p-value of 0.34 was not significant, indicating that the change in performance was likely due to random chance.

When using a chart as a strategy, there was a significant improvement in performance from the pretest (10.86) to the post-test (11.4). The p-value was significant, suggesting that the increase in performance was likely due to the effectiveness of using a chart as a learning strategy.

Similarly, when using the double and new double strategy, there was a significant improvement in performance from the pretest (10.2) to the post-test (11.93). The p-value was significant, indicating that the change in performance was likely due to the effectiveness of using this strategy as learning tools.

On the other hand, using the number line strategy did not result in a significant difference in performance between the pretest (9.8) and post-test (10.26). The p-value was not significant, suggesting that the change in performance was not likely due to the effectiveness of using the number line strategy further supporting the idea that not all strategies are equally effective in improving learning outcomes.

Overall, the average performance of learners in the control group improved from the pretest (9.86) to the post-test (10.86). The differences in performance were significant for using a chart and the double and new double strategies, indicating that these strategies were effective in improving learning outcomes in Math 1.

#### Experimental

Table 7 presents the difference in the performance of learner in math 1 in the pretest and post-test. The differences in the performance of learners in the experimental group in Math 1 between the pretest and posttest are analyzed based on the strategies used during the tests.

Table 7. Difference in the Performance of Learners of Experimental Group in Math 1 in the Pre and Post tests

Strategies	Pretest	Posttest	p-value	Interpretation @ $\alpha= 0.05$
I. Using counting up or back	9.27	12.8	5.84	Not significant
II. Using a chart	10.27	12.33	0.04	significant
III. Number Line	9.73	12.67	0.001	significant
IV. Double and new Double	10.73	13.13	0.003	significant
Average	10	12.73		

The results show that using a chart, number line, and double and new double strategies resulted in a significant improvement in the learners' performance, as indicated by the p-values of 0.04, 0.001, and 0.003 respectively. This means that these strategies were effective in helping the learners solve math problems more accurately and efficiently. On the other hand, using counting up or back strategy did not show a significant improvement in the learners' performance, as indicated by the relatively high p-value of 5.84. This suggests that this strategy may not have been as effective in aiding the learners in solving math problems compared to the other strategies mentioned.

The average improvement in the learners' performance from the pretest to the posttest was significant, with an average score increasing from 10 to 12.73. This indicates that the strategies implemented during the posttest were effective in helping the learners improve their math skills.

At the significance level of 0.05, it can be concluded that using a chart, number line, and double and new double strategies had a significant impact on the learners' performance in Math 1, while using counting up or back strategy did not show a significant improvement. These results highlight the importance of implementing effective teaching strategies to enhance student learning outcomes in math.

Furthermore, it is important for educators to continue to explore and implement various teaching strategies in order to address the diverse needs and learning styles of students. By incorporating a variety of strategies, educators can create a more inclusive and engaging learning environment that fosters academic growth and development for all learners.

Additionally, the results of this study suggest that hands-on and visual strategies such as using charts and number lines may be particularly effective in improving math performance. Educators can incorporate these tools into their lessons to help students better understand mathematical concepts and strengthen their problem-solving skills.

It is also important for educators to regularly assess student progress and adjust teaching strategies as needed to ensure continual improvement. By monitoring student performance and making data-driven decisions, educators can tailor their instruction to better meet the needs of their students and support their academic success.

Overall, this study highlights the importance of using effective teaching strategies to enhance student learning outcomes in math. By implementing a variety of strategies and regularly assessing student progress, educators can help students improve their math skills and achieve academic success.

### Difference in the Performance of Learners in the Control Group and Experimental Group in Math 1 in the Post-test

Table 8 presents the difference in the performance of learners between control group and experimental group in the post test after the use of mental math strategy.

The data compares the performance of learners using specific strategies in the experimental group with those not using the specified strategies in the controlled group. The p-values for each strategy are provided, with an interpretation at the alpha level of 0.05.

Table 8. Difference in the Performance of Learners between Control Group and Experimental Group in the Post test

Strategies	Control	Experimental	p-value	Interpretation @ $\alpha= 0.05$
I. Using counting up or back	9.8	12.8	0.001	Significant
II. Using a chart	11.4	12.33	0.32	Not Significant
III. Number Line	10.26	12.66	0.03	Significant
IV. Double and new Double	11.93	13.13	0.08	Not Significant
Average	10.84	12.73		

For strategies I and IV (using a chart and double & near double), the p-values of 0.32 and 0.08 are both greater than 0.05, indicating that the differences in performance between the experimental and control groups were not statistically significant. This suggests that these strategies did not have a significant impact on learner performance in the post-test.

However, for strategies I and III (counting up or back and using a number line), the p-values of 0.001 and 0.03 are both less than 0.05, indicating statistically significant differences in performance between the experimental and controlled groups. This suggests that these strategies had a significant impact on learner performance in the post-test that the learners benefitted from the number line and counting up or back and that the strategy is effective in enhancing addition and subtraction of learners.

Overall, the average performance of the experimental group (12.73) is higher than that of the control group (10.84), suggesting that the experimental group performed better in the post-test. However, the differences in performance between the two groups are only statistically significant in the strategies of using counting up or back and using a number line. The results point to the importance of utilizing effective teaching strategies to improve learning outcomes.

Educators should consider the effectiveness of different approaches to enhance learner performance.

Further analysis reveals findings on the four different activities under mental math strategies. When using a chart, the experimental group showed an average performance improvement of 12.33, while the control group had an average improvement of 11.4. Although there was an increase in scores for the experimental group, the p-value of 0.32 does not indicate significant significance. Similarly, using a double and near doubles showed an average improvement of 13.13 for the experimental group and 11.93 for the control group, with a p-value of 0.41 indicating no statistically significant difference in performance between the two groups.

On the other hand, using counting up or back and number line showed statistically significant differences in performance improvement between the experimental and control groups. The p-values of 0.001 and 0.03 for counting up or back and number line, respectively, indicate significant improvements in performance with these strategies. These findings are in line with previous studies that have shown the effectiveness of strategies such as counting up or back and using a number line in improving mathematical performance among learners. The significant difference in performance in these strategies suggests that incorporating them into teaching methods can lead to improved learning outcomes.

Additionally, the lack of significance in performance when using a chart or the strategy of double and near double may indicate that these methods are not as effective in enhancing mathematical skills among learners compared to other strategies. This highlights the importance of continuously evaluating and adapting teaching methods to ensure the best possible outcome for students. Also emphasizes the importance of using effective strategies in teaching to improve learning outcomes and suggest potential benefits in incorporating these strategies into practice. Further research may be needed to explore the full extent of their effectiveness in various settings.

According to Frykholm (2010), using the number line helps children develop greater flexibility in mental arithmetic as they actively construct mathematical meaning, number sense, and understanding of number relationships. The number line is used to support reasoning about the operations of addition and subtraction as children construct representations of additive composition or decompositions, and using the number line helps students develop qualitative understandings of numerical value in relation to lengths along the line. (Saxe, Diakow, & Gearhart (2013). It allows students to engage more consistently in the problem as they jump along the line in ways that resonate with their intuitions, and they are able to better keep track of the step they are taking, leading to a decrease in a memory load otherwise necessary to solve a problem (Frykholm 2010).

Jo Boaler wrote in his book entitled ““Mathematical Mindsets” that mental math strategies are important because they allow individual to solve math problems quickly and accurately in their head without the need for paper or calculator. This can help improve overall math skills, enhance problem solving abilities and increase confidence in mathematical abilities. Also, mental math strategies are essential for developing a strong foundation in mathematics. By

relying on mental math techniques, students can become more fluent in basic arithmetic operations and develop deeper understandings of mathematical concepts. This can lead to improved performance on standardized tests and better mathematical reasoning skills.

## CONCLUSION AND RECOMMENDATIONS

### Conclusion

The following are the conclusions based from the findings:

1. The very satisfactory performance of the grade 1 learners in the control group and experimental group before the use of mental math strategy is attributed to their orientation in the kindergarten and lessons learned on addition and subtraction in grade 1.
2. The very satisfactory performance of the grade 1 learners in the control group after the use of mental math strategy is attributed to their lesson learned in addition and subtraction in grade 1.
3. The outstanding performance of the grade 1 learners in the experimental group after the use of mental math strategy is attributed to the effectiveness of the instructional materials and drills under mental math.
4. The use of counting up or back and number line technique is effective in improving their level of performance in mathematics.

### Recommendations

The following are the recommendations based on the findings:

1. The schools and the teachers are encouraged to continue developing and enhancing the basic concepts of whole numbers of the learners using varied instructional materials such as manipulatives, games and the use of ICT.
2. The use of mental math strategy such as counting up or back and number line is encouraged to use by teachers in teaching Mathematics by crafting learning tools, visual aids whenever applicable.
3. Teachers and parents are encouraged to continue using counting up or back and number line technique as teaching strategy in teaching mathematics in different ways such as games, drills among others to enhance student learning outcomes in math.
4. Teachers are encouraged to provide opportunities for collaborative learning where students can work together to solve math problems, fostering a sense of teamwork and peer support through the use of different mental math strategies.

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