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Developing Basic Calculation Skills for Students with Intellectual Disabilities Through Counting Strategies in Inclusive Settings

Le Thi Tam[1]✉, Nguyen Thi Kim Hoa[2], Tran Van Cong[3]

[1] letamht@gmail.com
The Vietnam National Institute of Educational Sciences (Vietnam)
[2] hoalk@vnies.edu.vn
The Vietnam National Institute of Educational Sciences (Vietnam)
[3] congtv@vnu.edu.vn
Vietnam National University (Vietnam)
✉ Corresponding author

ABSTRACT: *Basic calculation skills are essential for early mathematical learning; however, many students with intellectual disabilities experience persistent difficulties in mastering basic addition and subtraction. This study examined the effectiveness of structured counting strategies in improving calculation skills among first-grade students with intellectual disabilities in inclusive school settings. A 12-week intervention was implemented with eight students, supported by their classroom teachers, who received targeted training on five core counting strategies for addition and subtraction within 10. Instruction was delivered through individualized sessions using concrete and pictorial materials. Student performance was assessed before and after the intervention, and teachers' use of counting strategies was also documented. Results showed substantial improvement in students' calculation accuracy. Prior to the intervention, most students performed at very low levels (0-20% accuracy). After 12 weeks, five students achieved high proficiency levels (90-100% accuracy) in addition, and four students reached similar levels in subtraction. Strategies such as count-all and count-on from the first addend produced the greatest gains, while count-back remained the most challenging. Teachers also demonstrated increased frequency and flexibility in applying counting strategies. The findings suggest that explicit instruction in counting strategies can effectively support basic calculation development for students with intellectual disabilities and provide practical implications for teacher training and inclusive mathematics instruction.*

KEYWORDS: **Students with intellectual disabilities, basic calculation skills, counting strategies, inclusive education.**

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1. Introduction

Basic calculation skills form the foundation of mathematical learning and are essential for both academic achievement and everyday functioning. The ability to add and subtract small numbers enables children to access higher-order mathematics, such as multiplication, division, and problem solving, and also supports daily tasks such as handling money, measuring quantities, or managing time. For most children, these skills are acquired gradually in the early grades of primary school through exposure to structured learning activities. However, for students with intellectual disabilities, the acquisition of even the simplest calculation skills remains a significant challenge.

A growing body of research has documented the persistent difficulties that students with intellectual disabilities face in mathematics. Kumatongo (2019) observed that many of these students lack core numerical concepts and are unable to participate effectively in classroom activities that require arithmetic. By the end of primary school, a substantial proportion of students with intellectual disabilities continue to struggle with even the most basic operations, such as single-digit addition and subtraction. Studies have shown that even students with relatively stronger learning capacity within this group still commit frequent errors, work at a much slower pace, and show difficulties in transferring strategies from one context to another (Geary, 2011; Bashash *et al*., 2003). These deficits not

only restrict academic progress but also limit opportunities for independent living and social participation later in life.

The implications are particularly significant in inclusive education, where students with intellectual disabilities are expected to learn alongside their typically developing peers. Limited mastery of calculation skills reduces the extent to which these students can engage meaningfully in classroom activities, respond to teacher instruction, or participate in group work. Moreover, without intervention, the gap between students with intellectual disabilities and their peers widens over time, reinforcing disadvantage and increasing the risk of exclusion. Consequently, the search for instructional approaches that are both effective and feasible in inclusive classrooms is an urgent priority.

Among the different instructional methods proposed, counting strategies have attracted increasing attention. Counting serves as a natural entry point into mathematics and remains accessible to most children, including those with developmental challenges. Research indicates that explicit instruction in counting can help students progress from rudimentary approaches, such as counting all objects, toward more advanced methods like counting on or counting back (Geary *et al*., 1992; Garnett, 1992). These strategies are developmentally sequenced, flexible, and low-cost, relying mainly on simple materials such as counters, number lines, or pictorial representations. For education systems with limited resources, such as those in many parts of the Global South, counting strategies provide a practical and scalable solution for supporting students with intellectual disabilities in mathematics.

Despite this potential, existing studies leave several important questions unanswered. Much of the research has been conducted in specialized settings rather than in inclusive classrooms, and interventions are often delivered by researchers or specialists rather than by regular classroom teachers. As a result, there is limited evidence about how general education teachers can incorporate counting strategies into their everyday practice and how feasible these strategies are in real school environments. Furthermore, while the effectiveness of counting has been demonstrated in general populations of students with mathematical difficulties, little is known about the specific conditions under which students with intellectual disabilities can successfully adopt different strategies, or about the instructional intensity required for measurable progress.

To address these gaps and to clarify the contribution of counting-strategy instruction for students with intellectual disabilities in inclusive school contexts, the present study focuses on both student learning outcomes and teachers' instructional implementation. Based on the identified research gaps, this study was guided by the following research questions:

1) To what extent do structured counting strategies improve basic addition and subtraction skills within 10 for first-grade students with intellectual disabilities?

2) Which counting strategies are associated with greater improvement in students' calculation performance?

3) How do classroom teachers apply and adapt counting strategies when supporting students with intellectual disabilities in inclusive school contexts?

2. Literature Review

2.1. The Conceptual Foundations and Benefits of Counting Strategies

Counting is widely regarded as one of the most fundamental skills in early mathematics and serves as the cornerstone for developing basic operations such as addition and subtraction. Long before children are introduced to formal arithmetic, they typically engage in counting activities to solve everyday problems, for example determining how many toys remain after some are removed or how many more objects are needed to complete a set. The mastery of counting requires an understanding of several key principles, including one-to-one correspondence, the stable order of number words, and cardinality. These principles ensure that children can accurately match number words to objects, maintain consistency in the order of

numbers, and recognize that the final count represents the total quantity (Geary, 2011).

Researchers have identified a developmental progression in the use of counting strategies, ranging from less to more sophisticated forms. Common strategies include **count-all**, where children enumerate both addends starting from one; **count-on from the first addend**, where the child holds the first number in mind and continues counting with the second addend; **count-on from the larger number**, which reduces cognitive load by beginning from the greater addend; **count-remaining**, used in subtraction by removing objects representing the subtrahend; and **count-back**, which requires counting backwards from the initial number (Geary *et al*., 1992). Each strategy differs in its efficiency and cognitive demands, but together they provide a repertoire that children can draw upon to approach a variety of numerical tasks.

The benefits of counting strategies extend beyond solving single problems. They support children's ability to flexibly manipulate numbers, strengthen working memory for numerical sequences, and foster the transition from concrete object-based reasoning to more abstract symbolic understanding (Garnett, 1992). By gradually shifting from simpler to more advanced strategies, children not only improve accuracy and fluency in arithmetic but also develop confidence in approaching mathematical challenges. This progression underscores the importance of teaching counting explicitly and systematically as an essential step in the broader development of mathematical competence.

2.2. Difficulties of Students with Intellectual Disabilities in Basic Calculation Skills

Students with intellectual disabilities often encounter persistent challenges in mastering basic calculation skills, especially in performing simple addition and subtraction tasks. Research has shown that these difficulties are linked to limitations in working memory, processing speed, and conceptual understanding of numbers (Geary, 2011; Geary *et al*., 2000). For example, many students with intellectual disabilities struggle to retain number facts, keep track of multi-step processes, or recognize the relationship between quantities and symbols. Such difficulties make it hard for students to achieve accuracy and fluency in addition and subtraction within 10, which are skills normally expected in the early years of primary school.

These barriers not only affect immediate performance but also restrict access to higher-level mathematical concepts. Without secure mastery of basic operations, students may be unable to engage in more advanced tasks such as problem solving, place value, or multiplication (Booker *et al*., 2015). Furthermore, traditional classroom instruction often assumes that children already possess a solid foundation in counting and number concepts, leaving students with intellectual disabilities at risk of falling behind when explicit scaffolding is absent (Bryant *et al*., 2008).

Importantly, however, these difficulties in calculation do not imply that students with intellectual disabilities are incapable of learning arithmetic. On the contrary, studies suggest that when instruction is adapted to their needs, particularly through the use of structured counting strategies, these students can achieve meaningful progress (Bashash *et al*., 2003; Doabler & Fien, 2013). The challenges therefore highlight the necessity of providing instructional methods that reduce cognitive load, rely on concrete and pictorial supports, and build fluency step by step. Counting strategies offer such an approach by enabling students to work with numbers in manageable ways while gradually developing independence in problem solving.

2.3. Empirical Studies on Counting Strategies for Students with Intellectual Disabilities

A considerable body of empirical research has demonstrated that structured counting strategies can significantly improve the calculation abilities of students with intellectual disabilities. These strategies provide learners with accessible entry points into arithmetic by making use of their existing counting knowledge while gradually guiding them toward more efficient problem-solving methods.

Bashash *et al*. (2003) investigated the counting

skills of students with moderate intellectual disabilities and found that, although these students initially relied on inefficient methods, systematic instruction in strategies such as count-all and count-on enabled them to achieve greater accuracy and independence in solving addition problems. Their study emphasized that when teachers explicitly modelled the process and provided sufficient practice, students were able to transition from concrete manipulation of objects to more symbolic forms of representation.

Other research has highlighted the importance of teaching counting strategies in carefully sequenced steps. Geary, Bow-Thomas, and Yao (1992) showed that students with mathematical difficulties benefited from moving gradually from counting all items to counting on, and eventually to strategies that minimized cognitive demands, such as counting on from the larger addend. This developmental trajectory has also been observed in students with intellectual disabilities, suggesting that they are capable of adopting more advanced strategies when instruction is explicit and sustained (Geary, Hoard, Byrd-Craven, & DeSoto, 2004).

Intervention studies further support these findings. Bryant *et al*. (2008) reported that first- and second-grade students with mathematical difficulties made significant progress in addition and subtraction when provided with booster lessons that included explicit strategy instruction. Similarly, Doabler and Fien (2013) stressed the role of explicit mathematics instruction in helping students with persistent learning difficulties master basic facts by reducing cognitive load and reinforcing step-by-step procedures. These insights are directly applicable to the education of students with intellectual disabilities, who benefit from consistent scaffolding and opportunities to practice strategies in different contexts.

Research has also shown that the use of manipulatives and visual supports enhances the effectiveness of counting strategies. Garnett (1992) argued that students with learning disabilities gained fluency in number facts when instruction combined counting strategies with the use of concrete and pictorial aids. Booker *et al*. (2015) similarly emphasized that primary mathematics instruction should build on children's natural counting abilities and provide them with multiple representations of number concepts. For students with intellectual disabilities, such supports reduce abstractness, increase engagement, and promote generalization of skills.

Overall, the empirical evidence indicates that although students with intellectual disabilities face considerable challenges in mathematics, they are still able to make progress in learning basic arithmetic when provided with explicit and systematic instruction in counting strategies. Such approaches have been shown to improve accuracy, fluency, and confidence, and therefore represent a practical and evidence-based method for supporting the development of basic calculation skills. At the same time, further research is needed to explore how these strategies can be most effectively implemented in inclusive classroom environments.

Although previous studies have provided strong evidence that counting strategies can improve the mathematical performance of students with learning difficulties and intellectual disabilities, several important gaps remain. Much of the current evidence is drawn from research conducted in special education settings, leaving open the question of how these strategies work in inclusive classrooms where learning conditions are more diverse. Moreover, interventions in many studies have been delivered by researchers or trained specialists rather than classroom teachers, raising concerns about feasibility in everyday practice. Another limitation is that most prior studies have focused on older students, even though the early years of primary school are a critical stage for developing addition and subtraction skills. These gaps point to the need for further research examining the application of counting strategies with first-grade students with intellectual disabilities in inclusive contexts, and for studies that investigate how teacher training and support can enhance both fidelity of implementation and student outcomes.

3. Methodology

3.1. Research Design

This study employed a quasi-experimental design without random assignment, as it was conducted in natural school settings where random allocation of students was not possible. The design aimed to evaluate both the changes in students' performance and the development of teachers' instructional practices. To provide a comprehensive picture, the study combined quantitative measures of student achievement with qualitative feedback from teachers.

Several types of data were collected from different sources. First, student performance on basic arithmetic tasks, specifically addition and subtraction within 10, was recorded after each session to track progress over time. These short and regular assessments helped to measure immediate learning outcomes. Second, weekly teacher feedback was gathered through structured forms as well as short verbal reports. This feedback provided insights into the teaching process, the difficulties encountered, and the ways in which students responded to the strategies. Third, the research team conducted random assessments during the intervention to verify the accuracy of reported data and confirm student progress independently.

By combining quantitative results with qualitative information, the design allowed for both statistical evaluation and a deeper understanding of how counting strategies were applied in inclusive classrooms. This mixed approach ensured that the findings reflected not only the measurable outcomes of the intervention but also the practical experiences of teachers and students.

3.2. Participants and Setting

The participants of this study were eight first-grade students with intellectual disabilities, aged between six and eight, and their eight classroom teachers. All of the students were identified by their teachers as having marked difficulties in performing addition and subtraction within 10. Their initial accuracy rates were typically between 20% and 40%, and they often made inconsistent errors and showed a tendency to forget number sequences. In addition, they had particular problems with counting backwards and applying strategies in a flexible manner. Although the students varied in ability levels, they all shared a need for structured support in order to strengthen their basic calculation skills.

The classroom teachers served as the main implementers of the intervention. They differed in their years of teaching experience, but most of them had limited formal training in teaching students with intellectual disabilities in inclusive classrooms. Prior to the start of the intervention, these teachers attended short training sessions conducted by the research team. During these sessions, they were introduced to the five counting strategies and practiced step-by-step ways to support students in using them. Teachers were also provided with simple teaching materials and practical examples. Communication between the teachers and the research team was maintained through in-person meetings, feedback forms, and an online communication group, which enabled teachers to receive continuous guidance and consultation throughout the study.

Although the study was conducted in inclusive school settings, the intervention itself was delivered through individualized sessions outside the regular classroom. This pull-out model was selected to ensure that students with intellectual disabilities received focused and uninterrupted support when learning new counting strategies. In the participating schools, regular classroom instruction did not allow sufficient time for intensive, individualized mathematics instruction, particularly for students requiring repeated demonstrations and guided practice. Therefore, the individualized sessions were used as a supplementary form of support rather than a replacement for classroom learning. Students continued to attend and participate in general education mathematics lessons alongside their peers. The pull-out sessions were intended to strengthen foundational calculation skills, enabling students to engage more meaningfully in inclusive classroom activities.

3.3. Training Content and Counting Strategies

Before starting the intervention, the research

team provided short training sessions to classroom teachers. The aim was to ensure that teachers felt confident in guiding students with intellectual disabilities through basic addition and subtraction tasks using structured counting strategies. The training emphasized step-by-step demonstration, the use of concrete and pictorial materials, and the importance of encouraging students to verbalize their counting. Teachers practiced each strategy during the sessions and discussed how to adapt them to the needs of each student with intellectual disabilities.

− *Count-all strategy:* Teachers were trained to show students how to represent both addends with objects and count all items from the beginning. For example, in "4 + 2", the teacher places four counters, adds two more, and prompts the student to count aloud: "one, two, three, four, five, six." The teacher reinforces that the last number counted represents the total.

− *Count-on strategy:* Teachers learned to encourage students to begin with the first addend and then continue counting forward. In "5 + 3", the teacher reminds: "Start with five. Now add three more counters. Let's count together: six, seven, eight." This helps students move beyond restarting from one each time.

− *Count-on from the larger number:* Teachers were instructed to explain that starting with the larger addend makes the process quicker. For "2 + 5", the teacher says: "We begin with five, because it's larger. Now count on two more: six, seven." Students are guided to recognize that this approach reduces the number of steps

− *Count-remaining strategy:* For subtraction, teachers were shown how to demonstrate removing objects. In "5 – 2", the teacher places five counters and asks the student to take away two: "Now, how many are left? Let's count: one, two, three." The teacher affirms that the answer is three, highlighting the idea of what remains.

− *Count-back strategy:* Teachers practiced supporting students in counting backwards, which is often more difficult. In "7 – 2", the teacher says: "Start at seven. Now count back two steps: six, five." The teacher provides extra prompts and repetition to help students master this strategy.

Through training, teachers practiced these strategies using simple materials such as counters, cubes, number lines, and pictorial cards. They were encouraged to model the process clearly, guide students through practice, and gradually support students to apply the strategies independently. By mastering these five approaches, teachers were prepared to provide structured and systematic support to their students with intellectual disabilities during the intervention.

3.4. Intervention Procedure

The intervention lasted for 12 weeks. Each week, students received five sessions, with each session lasting about 35–40 minutes. Sessions were scheduled within the official school timetable and were implemented during afternoon self-study periods (or equivalent designated support periods) that schools allocate for supplementary learning and individualized support. When scheduling constraints occurred, teachers adjusted session timing within these designated periods while maintaining the planned intervention schedule. The teachers were responsible for guiding their students in using the counting strategies to solve addition and subtraction problems within 10. They modelled the strategies, provided guided practice, and encouraged students to apply the strategies independently over time.

The research team supported the process in several ways. They first assessed student readiness and set learning targets. They organized meetings with teachers and parents to discuss assessment results and plan the intervention. Training for teachers included two face-to-face sessions and one online follow-up session on the use of counting strategies. Continuous consultation was provided throughout the 12 weeks to answer questions and ensure the intervention was applied consistently. In addition, the research team reviewed weekly teacher feedback and carried out random student assessments to confirm progress and maintain reliability.

The intensive schedule of the intervention (five sessions per week over 12 weeks) was intentionally designed to provide sufficient

practice opportunities for students with intellectual disabilities, who typically require repeated and structured exposure to basic calculation strategies. However, we acknowledge that such a schedule may raise feasibility concerns in real school contexts, particularly in relation to time allocation within school timetables and potential student fatigue. To address these concerns, sessions were kept short (35–40 minutes), adjusted flexibly based on each student's stamina, and were implemented during designated support periods rather than during core mathematics instruction. Teachers were encouraged to discontinue or shorten sessions when students showed signs of tiredness or reduced engagement. Although the schedule may not be easily replicated in all school settings, it reflects a high-intensity support model aimed at examining the potential of counting strategies under optimal instructional conditions. The feasibility of implementing such an intensive intervention on a larger scale is therefore discussed as a limitation and an important consideration for future research.

4. Results

4.1.Teachers' Use of Counting Strategies in Teaching Addition and Subtraction to Students with Intellectual Disabilities

In this study, five core counting strategies were introduced and implemented: count-all, count-on from the first addend, count-on from the larger number, count-the-remaining, and count-back. Each strategy was practiced using two instructional variants, namely concrete materials (e.g., counters, sticks) and pictorial representations (e.g., pictures, cards), depending on students' levels of abstraction. These variants were treated as different representational forms of the same underlying strategy rather than as distinct strategies. This approach allowed teachers to flexibly adapt instruction while maintaining consistency with the five core strategies introduced during training.

The pre-intervention results illustrated in Fig.1 show that the majority of teachers had limited knowledge and experience in using counting strategies to support addition and subtraction for students with intellectual disabilities. None of the eight participating teachers reported using any counting strategy frequently.

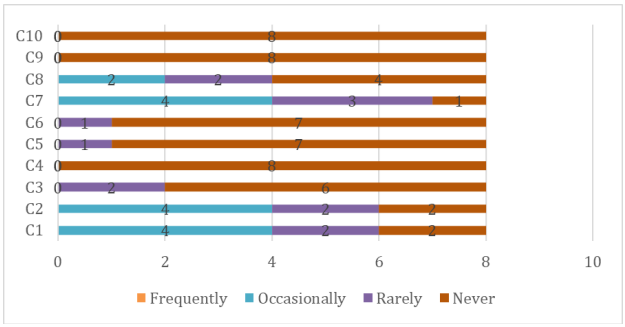

Figure 1. Teachers' use of counting strategies for students with intellectual disabilities before the Intervention

Note: C1 = Count-all strategy using real objects; C2 = Count-all strategy using pictorial representations; C3 = Count-on from the first addend using real objects; C4 = Count-on from the first addend using pictorial representations; C5 = Count-on from the larger addend using real objects; C6 = Count-on from the larger addend using pictorial representations; C7 = Count-the-remaining strategy using real objects; C8 = Count-the-remaining strategy using pictorial representations; C9 = Count-back strategy using real objects to represent the subtrahend; C10 = Count-back strategy using pictorial representations to represent the subtrahend. To avoid repetition, the codes C1–C10 will be used to refer to the corresponding counting strategies in the following charts of this paper.

The "count-all" strategy was the only approach that a few teachers reported using occasionally or rarely. Specifically, 4 out of 8 teachers occasionally used this strategy with either real objects or pictorial representations. Similarly, the "count-the-remaining" strategy was applied infrequently, with only 1–2 teachers indicating any prior use.

All other strategies, especially "count-on" (including count-on from the first addend and from the larger addend) and "count-back" strategies, were almost completely unfamiliar to the teachers. Between 7 and 8 out of 8 teachers reported never using these strategies in their instruction.

These findings suggest that most teachers relied on simple counting approaches and had not systematically implemented diverse counting strategies in their teaching. This highlights the need for targeted training to equip teachers with

a broader and more structured understanding of counting strategies that can effectively support learners with intellectual disabilities.

Under the direct guidance of the research team, the teachers participating in the intervention made significant changes in their use of counting strategies when teaching addition and subtraction skills to students with intellectual disabilities. The results are presented in Fig.2:

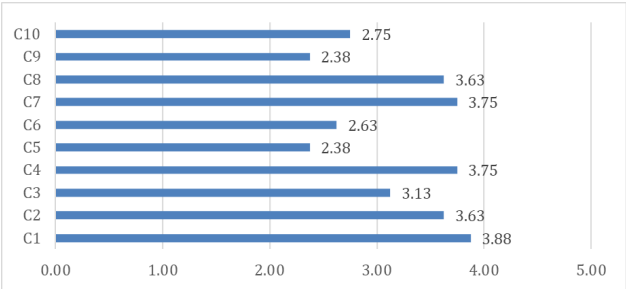

Figure 2. Teachers' use of counting strategies to support addition and subtraction (post-intervention)

Compared to the pre-intervention phase, during which none of the counting strategies were used frequently, teachers demonstrated a substantial increase in both the frequency and diversity of strategy use after the intervention. Strategies that relied on highly concrete representations, particularly the count-all strategy and the count-the-remaining strategy using real objects, showed the highest levels of application. This pattern suggests that teachers tended to prioritize strategies that were more accessible and easier for students with intellectual disabilities to understand and apply. In contrast, strategies requiring higher cognitive demands, such as count-on from the larger number and count-back, were used less frequently, even after training. These findings indicate that teachers' instructional choices were strongly influenced by students' immediate success and responsiveness, highlighting the importance of aligning strategy selection with students' developmental readiness.

To provide a more detailed comparison, Table 1 presents the mean scores and rank order of each strategy. This summary highlights which strategies were prioritized by teachers in their instruction after the training sessions.

4.2. Student Performance (pre- and post-intervention)

Student performance was assessed using teacher-developed tasks focusing on addition and subtraction within 10. Each task required students to solve problems using counting strategies introduced during the intervention. Student accuracy was calculated as the percentage of correctly solved items. Based on accuracy rates, performance was categorized

Table 1. Mean Scores and Rank Order of Teachers' Use of Counting Strategies to Support Addition and Subtraction (Post - Intervention)

Counting strategy	Mean score	Rank order
C1 - Count-all strategy using real objects	3.88	1
C2 - Count-all strategy using pictorial representations	3.63	3
C3 - Count-on from the first addend using real objects	3.13	4
C4 - Count-on from the first addend using pictorial representations	3.75	2
C5 - Count-on from the larger addend using real objects	2.38	7
C6 - Count-on from the larger addend using pictorial representations	2.63	6
C7 - Count-the-remaining strategy using real objects	3.75	2
C8 - Count-the-remaining strategy using pictorial representations	3.63	3
C9 - Count-back strategy using real objects to represent the subtrahend	2.38	7
C10 - Count-back strategy using pictorial representations to represent the subtrahend	2.75	5

into four proficiency levels: Level 1 (0–20% correct), Level 2 (30–50% correct), Level 3 (60–80% correct), and Level 4 (90–100% correct). This classification allowed for a clear comparison of student performance before and after the intervention, as well as an examination of individual progress patterns.

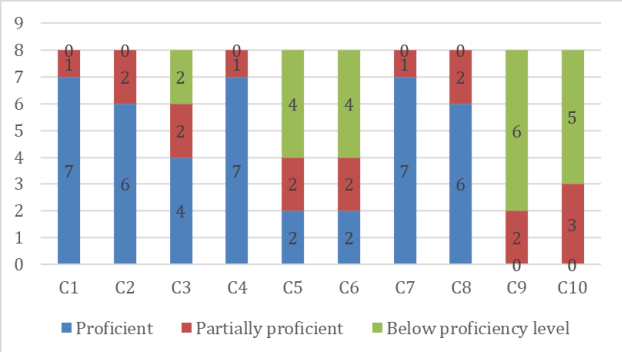

Figure 3. Proficiency levels of students with intellectual disabilities in using counting strategies

Fig.3 illustrates the proficiency levels of students with intellectual disabilities in applying ten counting strategies after the 12-week intervention. In general, students with intellectual disabilities demonstrated the ability to use a variety of counting strategies to solve addition and subtraction problems within 10. Among the five strategies supporting addition, "count-all" and "count-on from the first addend" (with both real objects and pictorial representations) were used more frequently and achieved higher levels of proficiency. Specifically, 7 to 8 out of 10 students were rated as proficient in these strategies. This result may be attributed to the fact that most students had already acquired basic skills such as rote counting and meaningful counting. The "count-on from the larger addend" strategy, although introduced and applied, showed lower proficiency rates (only 5 – 6 students proficient), indicating that the ability to compare two numbers remains a challenge for many students. For subtraction, the "count-the-remaining" strategy was used more effectively than the "count-back" strategy. In both forms of the count-back strategy (using real objects and pictorial representations), only 2 students reached the proficient level, while 5 to 6 students remained below the proficiency threshold. This suggests that backward counting remains one of the most difficult skills for students with intellectual disabilities, even with structured support.

The intervention process also recorded positive changes in teachers' use of concrete teaching materials (mathematics manipulatives). Rather than relying mainly on fingers as before, teachers incorporated a greater variety of manipulatives aligned with students' interests, such as counting sticks, buttons, or small counters. This change made the learning activities more engaging and helped the students maintain better focus while practicing the strategies, thereby enhancing the overall effectiveness of the instructional support.

Thanks to being equipped with counting strategies and participating in guided practice with teachers, the group of students with intellectual disabilities showed positive outcomes after the intervention process. The two charts below are presented side by side to better illustrate the changes observed in the students before and after participating in the experimental study.

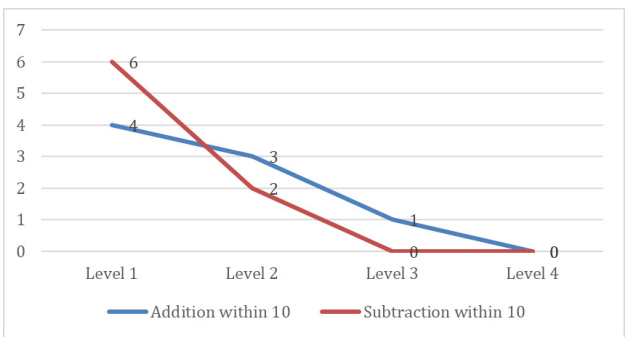

Figure 4. Addition and subtraction test results (within 10) of students with intellectual disabilities (Pre – test)

Note: Level 1: 0–20% correct; Level 2: 30–50% correct; Level 3: 60–80% correct; Level 4: 90–100% correct.

Fig.4 shows that nearly all students with intellectual disabilities performed below the average level in basic addition and subtraction within 10. In the addition task, only one student reached level 3 (60–80% correct), and one student reached level 2 (30 – 50%). The remaining six students were classified at level 1, corresponding to an accuracy rate of 0–20%. In subtraction,

one student reached level 3 and two students reached level 2, while five students remained at Level 1. Notably, no students achieved level 4 (90–100% correct) in either operation. These results indicate that, prior to the intervention, most of the students demonstrated low or very low levels of proficiency in basic computation, with subtraction posing greater difficulty than addition.

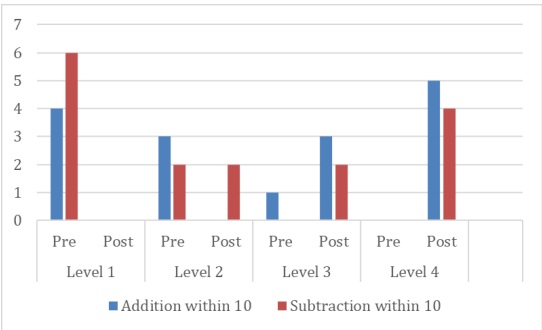

Figure 5. Comparison of pre- and post-test performance in addition and subtraction within 10 among students with intellectual disabilities

The comparison of pre - and post - test results revealed a clear shift toward higher proficiency levels across both addition and subtraction tasks. Prior to the intervention, most students performed at Level 1, indicating very limited calculation accuracy. After 12 weeks, the majority of students moved to Levels 3 and 4, reflecting substantial improvement in calculation performance. Although all students demonstrated progress, the degree of improvement varied. Some students achieved near-perfect accuracy, particularly in addition tasks using count-all and count-on strategies, while others showed more gradual gains, especially in subtraction tasks involving count-back. This variability highlights the heterogeneous learning profiles of students with intellectual disabilities and underscores the importance of individualized instructional support.

5. Discussions

The findings of this study indicate that structured training in counting strategies led to noticeable changes in both teachers' instructional practices and students' calculation performance. Following the intervention, teachers applied a wider range of counting strategies more frequently when supporting students with intellectual disabilities, while students demonstrated improved accuracy in solving addition and subtraction problems within 10. Overall, the results suggest that counting strategies can be meaningfully integrated into instructional support for students with intellectual disabilities in inclusive school contexts.

One notable pattern observed in the findings was teachers' preference for strategies involving concrete representations, particularly count-all and count-the-remaining using real objects. These strategies appeared to be more accessible for students with intellectual disabilities, as they reduce cognitive demands by making numerical relationships visible and tangible. Such representations may support learners who experience difficulties with working memory, abstract reasoning, and number manipulation. Consistent with previous research, strategies that offered immediate feedback and observable outcomes were more readily adopted by teachers, especially when students demonstrated clearer understanding or achieved immediate success during instruction.

In contrast, strategies requiring higher levels of cognitive processing, such as count-back and counting on from the larger number, remained challenging for many students, even after structured training. This suggests that more complex strategies may require longer and more scaffolded instruction before students can apply them independently. The observed variability in students' performance highlights the heterogeneous learning profiles of students with intellectual disabilities and underscores the importance of differentiated instructional planning in inclusive mathematics education.

The study also provides insight into teachers' instructional decision-making processes when implementing counting strategies. Teachers adjusted their choice and frequency of strategies based on students' responsiveness, accuracy, and engagement during lessons. Rather than

applying all strategies uniformly, teachers tended to prioritize those that aligned with students' immediate learning needs and observable progress. This adaptive use of strategies reflects the role of teachers as active decision-makers in inclusive classrooms and highlights the importance of professional judgment when supporting students with diverse learning profiles.

Although the intervention in this study was delivered through individualized pull-out sessions, the findings suggest practical ways to integrate counting strategies into instructional support activities within inclusive school settings. A feasible approach is to combine brief whole-class strategy routines with targeted support for students with intellectual disabilities. At the whole-class level, teachers can explicitly model one strategy at a time (e.g., count-all or count-on) using manipulatives, dot cards, or number lines, and embed short strategy practice into daily warm-up activities. This helps establish shared strategy language and normalizes strategy use for all students. For students with intellectual disabilities, teachers can then provide additional guided practice through small-group or individualized support sessions (push-in during classroom work time or scheduled support periods), focusing on repeated demonstrations, immediate feedback, and gradual fading of concrete supports. This blended model maximizes participation in the general classroom while ensuring the intensity and scaffolding needed for learners who require more structured practice, thereby aligning strategy instruction with inclusive education principles. Despite these positive findings, several limitations should be acknowledged. Although the study was conducted in inclusive school settings, the intervention was implemented through individualized pull-out sessions outside the regular classroom. While this approach allowed for focused and uninterrupted instruction, it limits the extent to which the findings can be generalized to fully classroom-integrated instructional models. In addition, the intensive intervention schedule may not be feasible across all school contexts, particularly in settings with limited staffing or instructional time. These constraints should be considered when interpreting the results and planning future applications.

Overall, the findings of this study suggest that structured counting-strategy instruction can play a supportive role in developing basic calculation skills for students with intellectual disabilities in inclusive settings. Future research should examine how such strategies can be more effectively integrated into regular classroom instruction, explore longer-term interventions for more complex strategies, and investigate how teacher training can further support adaptive and differentiated use of counting strategies in inclusive mathematics education.

6. Conclusions and Recommendations

This study provides evidence that structured counting strategies can support the development of basic addition and subtraction skills for first-grade students with intellectual disabilities. When teachers received focused training and ongoing support, students demonstrated meaningful improvements in calculation accuracy, particularly when using strategies that relied on concrete representations and lower cognitive demands.

The findings suggest that counting strategies are a practical and accessible instructional approach for supporting students with intellectual disabilities in inclusive school settings. However, the reliance on individualized intervention highlights the need for careful consideration of feasibility and alignment with inclusive education principles. Future research should examine how counting strategies can be more fully integrated into regular classroom instruction and explore fewer intensive models that remain effective while being scalable in real-world school contexts.

Overall, the study contributes to the growing body of research on inclusive mathematics education by demonstrating both the potential benefits and the practical challenges of implementing strategy-based interventions for students with intellectual disabilities.

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