Journal of Psychology & Behavior Research
ISSN 2640-9895 (Print) ISSN 2640-9909 (Online)
Vol. 8, No. 1, 2026
www.scholink.org/ojs/index.php/jpbr

Original Paper

Using the Organized Problem-Based Computation Intervention (OPBCI) to Support Arithmetic Word-Problem Solving in Fifth Graders with Learning Difficulties: A Single-Case Study

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Received: January 15, 2026 Accepted: January 28, 2026 Online Published: February 10, 2026

doi:10.22158/jpbr.v8n1p1 URL: http://dx.doi.org/10.22158/jpbr.v8n1p1

Abstract

The present study investigated the use of the Organized Problem-Based Computation Intervention (OPBCI) within a single-case experimental framework. This instructional routine systematically employs graphic organizers to support arithmetic word-problem solving among students who require strategic assistance. Using a staggered multiple-baseline across-participants design, four fifth graders (two girls, two boys; aged 10-11) from a linguistically and socioeconomically diverse German lower-secondary school received 9-11 individual intervention sessions following baseline phases. Word-problem performance was measured using curriculum-based probes assessing correct identification of start, change, operation, and result quantities. Visual analysis and Tau-U indices indicated higher performance levels during intervention phases relative to baseline (τ = .57-.78). However, patterns of change varied across students and were, in some cases, constrained by baseline trends or ceiling effects. Social validity ratings were uniformly positive: students rated the OPBCI as useful, enjoyable, and easy to follow and reported that the graphic organizer supported their understanding of word-problem structure. Overall, the findings suggest that OPBCI may offer feasible, short-term instructional support for organizing arithmetic word-problem work in inclusive educational settings, while highlighting the need for cautious interpretation and further research.

Keywords

graphic organizer, word problems, multiple-baseline single-case design, arithmetic problem solving, inclusive education, Tier-2 intervention

1. Introduction

Mathematical competence is a critical foundation for academic achievement, participation in everyday life, and long-term vocational success. Among the many skills elementary students must acquire, the ability to solve arithmetic word problems is particularly important, as it reflects both conceptual understanding and the capacity to apply learned knowledge and strategies in real-world contexts (Boonen et al., 2016). Nevertheless, this area is repeatedly reported as one of the most demanding aspects of mathematics learning in elementary education. What makes word-problem solving especially challenging is the fact that successful performance requires not only computational proficiency but also language comprehension, working memory, and executive control—capacities that pose substantial challenges for many students (Fuchs et al., 2024; National Assessment of Educational Progress, 2019). In addition, the process involves translating linguistic information into quantitative relationships. Many learners struggle to identify relevant information, distinguish between known and unknown quantities, and select appropriate operations (Gersten et al., 2009a; Fuchs et al., 2020). As a result, even students who can accurately perform the basic arithmetic operations may fail to solve text-based problems correctly. Addressing these challenges is therefore a central focus of research in mathematics education (Hickendorff, 2021).

Large-scale national assessment data from the National Assessment of Educational Progress (NAEP) indicate that substantial mathematics difficulties are widespread among U.S. elementary students, particularly for tasks requiring the application of mathematical knowledge in meaningful contexts, such as arithmetic word problems. Results from the 2022 NAEP mathematics assessment show limited overall proficiency: nationally, 36% of fourth-grade students performed at or above the NAEP Proficient level, while 25% performed below the NAEP Basic level, suggesting that a substantial proportion of students lack foundational mathematical competence. NAEP mathematics assessments emphasize multi-step, context-based problem solving rather than isolated procedural calculations. Trend data further indicate that these difficulties are evident across the performance distribution and across nearly all states and jurisdictions, underscoring their persistence over time. Taken together, NAEP findings suggest that competence in solving arithmetic word problems cannot be assumed for a substantial share of students by the end of elementary school (National Center for Education Statistics, 2022).

Importantly, research indicates that these difficulties are not immutable. Over the past two decades, a growing body of evidence has identified instructional components that are especially effective in supporting mathematical problem solving among struggling learners. Studies consistently show that interventions explicitly targeting the core reasoning, representation, and self-regulation processes required for linguistically mediated, conceptually demanding tasks improve accuracy and strategic performance across age groups and ability levels. Meta-analyses document generally positive effects for both elementary and secondary students with mathematical problem-solving difficulties (Kong et al., 2021; Myers et al., 2022). Prior research further highlights the benefits of explicit and systematic instruction, the use of visual representations, structured strategy instruction, and verbal mediation (Gersten et al., 2009a; Lein et al., 2020; Shin et al., 2021). These elements help students organize problem content, attend to underlying mathematical structure, and develop metacognitive awareness of the reasoning steps involved in generating solutions. Interventions that integrate these principles have shown particular promise in inclusive classroom settings, where teachers must balance individualized support with the demands of whole-class instruction (Gersten et al., 2009b).

One promising approach for supporting word-problem solving is schema-based instruction (SBI), which provides a conceptual framework for organizing arithmetic tasks according to their underlying quantitative structure. SBI incorporates instructional components such as explicit instruction, visual representations, and strategy training—elements that meta-analytic research has identified as particularly effective for individuals with learning difficulties. Within SBI, students use visual representations, commonly referred to as graphic organizers, to depict the quantitative relationships in word problems (see Figure 1 for an example). These tools can reduce linguistic demands, support working memory, and make abstract relationships visible (Griffin & Jitendra, 2009). By integrating verbal information with symbolic understanding, SBI supports students in constructing coherent mental models of mathematical situations (e.g., Clausen et al., 2021; Cook et al., 2020; Myers et al., 2022).

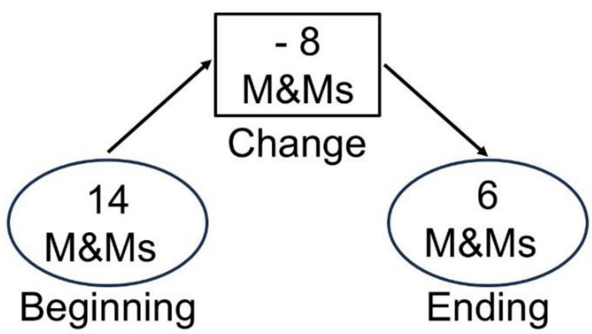

Figure 1. Example of a Change (Decrease) Word-Problem Schema: "Liam had 14 M&Ms. He ate 8 M&Ms. Liam now has 6 M&Ms left".

To operationalize this conceptual framework at the level of instruction, the present study draws on principles of Overt Pre-current Behavior Chain Instruction (OPBCI), an approach from applied behavior analysis introduced by Neef and colleagues (2003) and grounded in Skinner's (1953, 1957) conceptualization of problem solving as a sequence of pre-current behaviors. OPBCI conceptualizes performance as a chain of observable verbal and written actions that precede and facilitate the final response. In the context of arithmetic word problems, this includes identifying the initial set, the change set, the operation, and the resulting set before computing the answer. By structuring instruction into explicit, stepwise, and observable components, OPBCI provides a systematic routine that guides students' reasoning through the task while remaining compatible with schema-based representations of problem structures.

In their seminal study, Neef et al. (2003) demonstrated that learners with developmental disabilities could acquire a sequenced set of overt precurrent responses—identifying the initial quantity, change quantity, required operation, and resulting quantity—that reliably supported correct solutions to previously untaught arithmetic word problems. The authors showed that establishing these precurrent responses led to marked increases in correct responding on novel problems. Building on this work, Levingston et al. (2009) extended the application of OPBCI in several important ways. They broadened the instructional scope to include multiplicative word problems. They examined their effectiveness with elementary-aged students with autism, thereby expanding both the mathematical content domain and the learner population. Results again demonstrated strong gains in accuracy, indicating that the acquisition of the same sequence of overt precurrent responses supported successful performance beyond the original context studied by Neef et al. More recently, Zhou et al. (2024) further extended this line of research with Chinese primary school students with autism, confirming the effectiveness of OPBCI for improving accuracy and generalization across both in-person and telehealth teaching formats. Taken together, these studies show that OPBCI reliably produces rapid gains in identifying relevant quantities, selecting appropriate operations, and completing arithmetic word problems independently across diverse populations and instructional contexts.

Despite these encouraging findings, research on OPBCI remains limited in scope and ecological validity. Existing studies have focused primarily on students with developmental disabilities and have typically been conducted in highly controlled or specialized instructional settings. Consequently, little is known about the effectiveness of OPBCI for learners with persistent difficulties in arithmetic word problems in inclusive general education classrooms. This represents an important gap, as instructional practice in inclusive settings requires interventions that are both evidence-informed and feasible for small-group or targeted implementation within everyday school routines. From this perspective, OPBCI appears particularly promising, combining the analytic precision of behavior-based instruction with a simple, visually structured, and teacher-friendly routine aligned with general education practices emphasizing strategic reasoning and graphic representation.

Beyond addressing this gap, examining OPBCI in inclusive classrooms may also inform broader discussions of how structured, language-supported instruction fosters mathematical understanding among learners with diverse needs. Given that performance on arithmetic word problems strongly predicts later achievement in algebra and higher mathematics, identifying effective approaches to support comprehension, reasoning, and transfer remains of substantial educational importance (Fuchs et al., 2014).

Accordingly, we sought to replicate and extend prior OPBCI research by examining its effectiveness with students at the transition from primary to secondary education in an inclusive comprehensive secondary school. At this developmental stage, competence in arithmetic word problems is typically expected to be established; persistent difficulties, therefore, signal elevated risk for ongoing challenges in mathematics learning. Our research questions were as follows:

(1) Does brief, structured graphic-organizer instruction based on OPBCI improve arithmetic word-problem performance in fifth-grade students with classroom-identified difficulties in organizing and translating word-problem information, as measured by correct identification of the start quantity, change quantity, operation, and result, as well as by total scores on a curriculum-based measure, within a staggered multiple-baseline single-case design?

(2) How do participating students perceive the OPBCI in terms of its acceptability, usefulness, and feasibility for supporting arithmetic word-problem work?

2. Method

2.1 Participants and Setting

The study was conducted at a lower-secondary school in Germany serving a linguistically and socioeconomically diverse urban catchment area. Our focus was on fifth-grade students who demonstrated persistent, classroom-based difficulties with arithmetic word problems, identified through converging sources of instructional evidence. These included teacher observations, analyses of curriculum-aligned classroom work, and repeated informal word-problem probes administered as part of regular instruction. In line with common school-based practice in the local German educational context and with prevention-oriented research approaches, no standardized diagnostic instruments for mathematical word problems were used for formal identification.

To further describe students' academic profiles and to support instructional decision-making, performance data from mandatory, class-wide, curriculum-aligned assessments were examined. These covered reading comprehension, spelling, basic arithmetic, and short written composition. Raw scores were converted to standardized z-values to allow for within-cohort comparisons. The instruments used were German-language measures routinely employed in school-based practice but are not publicly available; therefore, detailed test descriptions are omitted. Additional information about these measures can be obtained from the first author upon request.

Inclusion criteria were defined to ensure both meaningful access to the intervention and a clearly documented need for strategic support in arithmetic word-problem performance. Because success in this area requires the coordination of linguistic comprehension, information structuring, and basic numerical competence, participants were selected to meet specific instructional prerequisites rather than diagnostic categories.

Specifically, criteria included (a) average spelling performance to reduce confounding effects related to orthographic accuracy and to ensure that written output did not obscure underlying reasoning processes; (b) pronounced weaknesses in written text production and organization ($z < -1.0$), reflecting difficulties in structuring and integrating linguistic information—a core demand of arithmetic word problems; and (c) average addition skills combined with marked difficulties in multiplication, ensuring access to fundamental quantity concepts while preserving a clear need for explicit, strategy-based support in translating textual information into mathematical operations. This pattern of relative strengths and weaknesses was considered critical for isolating difficulties in problem representation and strategic reasoning rather than deficits in calculation per se.

Based on these criteria, four students (two girls and two boys; ages 10-11) from two parallel fifth-grade classes were selected to participate: Anna (10-year-old monolingual German girl), Bea (11-year-old monolingual German girl), Can (10-year-old bilingual German-Turkish boy), and Davut (11-year-old bilingual German-Azeri boy). Pseudonyms were used to protect participant anonymity. All participants demonstrated substantial and instructionally relevant academic challenges, particularly in arithmetic word-problem performance. Only one student (Davut) had a formally identified learning disability; the remaining three participants had no special education designation. Regardless of diagnostic status, Anna, Bea, Can, and Davut exhibited learning profiles warranting targeted support from a preventive and inclusive instructional perspective.

2.2 Design

An experimental, quantitatively oriented single-case methodology was used, employing a multiple-baseline-across-participants variant of an AB design. The dependent variable was measured repeatedly across all phases, with staggered intervention onsets after 3, 4, 5, or 6 baseline sessions to strengthen internal validity against maturation and history effects. Experimental control was supported through (a) systematic manipulation of the independent variable (graphic-organizer–based strategy instruction), (b) clear phase separation, (c) a minimum of three baseline data points per participant, and (d) at least nine intervention data points per student. Anna, Bea, Can, and Davut were randomly assigned to baseline lengths, and fifteen probes were scheduled for each student.

2.3 Dependent Variable

Word-problem performance served as the dependent variable and was assessed using a curriculum-based measure (CBM; 0-20 points per probe). Each of five word problems contributed up to four rubric points: correct identification of the start quantity, change quantity, operation (addition/subtraction), and result. The CBM was adapted from the protocol developed by Zhou et al. (2024). To evaluate scoring reliability, a blind research assistant independently double-scored a random subset of probes, yielding perfect interrater agreement (100% concordance). Given the use of explicit scoring rules and objectively identifiable response components, perfect agreement was considered realistic and expected.

2.4 Materials

Instruction and assessment centered on a stepwise graphic organizer comprising three squares (for Start, Change, End/Result) and one circle (operation symbol). A pool of age-appropriate word problems (numbers 0-200) was developed for both instruction (unscored practice) and assessment (scored probes); items embedded familiar names, common verbs (e.g., “gets”, “gives”, “loses”, “finds”), and everyday objects (e.g., coins, stickers, books) while avoiding unfamiliar vocabulary. Item structure systematically varied the position of the unknown and the linguistic framing (Change, Combine schemas). Standardized instruction cards, scripted prompts, and think-alouds. A progress booklet (“Math Pass”) displayed individual line charts for self-monitoring and housed a star-and-sticker reinforcement system. Timers ensured a fixed probe duration. A coding sheet with decision rules supported objective scoring.

2.5 Procedures

2.5.1 Baseline Phase

All sessions were conducted individually in a quiet resource room during the morning instructional block and were delivered by two trained master’s students using standardized scripts and materials. Each session consisted of 20 minutes of structured interaction, followed by a brief performance assessment.

During baseline, students first spent 20 minutes in neutral, non-mathematical activities (e.g., simple games) with no academic coaching, matching the duration of the instructional component used during intervention. Immediately thereafter, they completed a standardized five-item curriculum-based measurement probe within a fixed five-minute time limit, as described in the Dependent Variable section. No strategy cues, feedback, or assistance were provided before, during, or after probe administration to preserve measurement objectivity.

2.5.2 Intervention Phase

The intervention comprised 15 individual sessions per student and was delivered on consecutive school days where feasible. As in the baseline, each session consisted of 20 minutes of structured interaction, followed by a brief, fixed-time performance assessment. As mentioned above, intervention onset was staggered across participants following three, four, five, or six baseline sessions, respectively.

Each intervention session began with a brief (approximately one-minute) review of the student’s individual progress chart and a concise statement of the instructional goal for that session. The instructor then provided explicit, corrective feedback on common errors observed in the previous probe, without disclosing correct responses to upcoming assessment items.

Instruction followed a structured direct-instruction sequence (“I do, we do, you do”). During the I do phase, the instructor modeled each target step using scripted think-alouds composed of short, simple utterances (maximum five words per statement). Initial teaching focused on accurate identification of the start quantity in the problem text. Students were taught to underline relevant signal words (e.g., at first, initially, has) and to record the corresponding value in the left square of the graphic organizer.

Once this step was performed reliably, instruction progressed to identifying the change quantity and determining whether it represented an increase or a decrease. Students highlighted action verbs (e.g., gets, gives, loses, finds) and entered the corresponding value into the center square. The final step targeted the selection of the appropriate operation, with the corresponding symbol (+ or −) written in the central circle of the organizer.

During the “we do” phase, the instructor and student jointly solved one to two exemplar problems using a most-to-least prompting hierarchy combined with immediate error correction (model → guided repetition → independent attempt). Prompts were systematically faded both within and across sessions to promote independent responding. In the “you do” phase, students independently solved two to four novel problems while the instructor provided specific praise for correct use of the strategy steps and brief, neutral corrective feedback for errors.

Problem difficulty was increased gradually across sessions by varying the position of the unknown quantity and introducing linguistically denser, yet age-appropriate, problem formulations. To limit cognitive load, all numerical values remained within the range of 0–200, and unfamiliar vocabulary was avoided throughout.

Following the instruction, participants completed the same fixed-time CBM probe used during baseline (see Dependent Variable). Assessment format, administration, scoring procedures, and feedback conditions were identical across phases to ensure measurement objectivity and comparability. Performance-based sticker reinforcement followed the same criteria as in prior sessions.

2.6 Treatment Fidelity

To ensure implementation integrity, both instructors used a session checklist detailing required steps for baseline and intervention. In 20% of all lessons per student (3/15), the non-teaching researcher conducted live fidelity observations, marking adherence (delivered/not delivered) and quality notes (prompting, pacing, error correction). Across sessions, instructors completed brief logs documenting timing, materials, deviations, and contextual events. Joint delivery of the first three sessions per student aligned with modelling language and prompting hierarchies. Fidelity artifacts (checklists, logs) were retained for audit and informed mid-course corrections.

2.7 Social Validity

Following the final session, each participant completed a brief, child-friendly social validity questionnaire using a four-point icon scale ranging from “thumbs down” to “thumbs up”. The questionnaire assessed key dimensions of social validity, including acceptability, perceived usefulness, clarity of the instructional procedure, and willingness to continue or recommend the method.

In addition, short semi-structured interviews were conducted to capture students’ open-ended reflections on which aspects of the intervention they found helpful or challenging, as well as suggestions for improvement (e.g., a desire for more colorful examples or additional writing space).

These qualitative responses were used to complement questionnaire ratings and to provide contextual insight into students' experiences with the intervention.

Teachers were debriefed on instructional procedures and interim student progress to obtain informal feedback regarding classroom fit and potential alignment with regular mathematics instruction. No systematic teacher ratings were collected.

Social validity evidence was analyzed descriptively and used to contextualize quantitative outcome data, to support interpretation of observed performance changes, and to inform potential refinements for future classroom-based implementation.

3. Result

All participants completed the planned study sequence, with only a small number of data points missing due to organizational issues. No adverse events occurred for any participant during either baseline or intervention phases. Figure 2 displays the performance trajectories of all four participants.

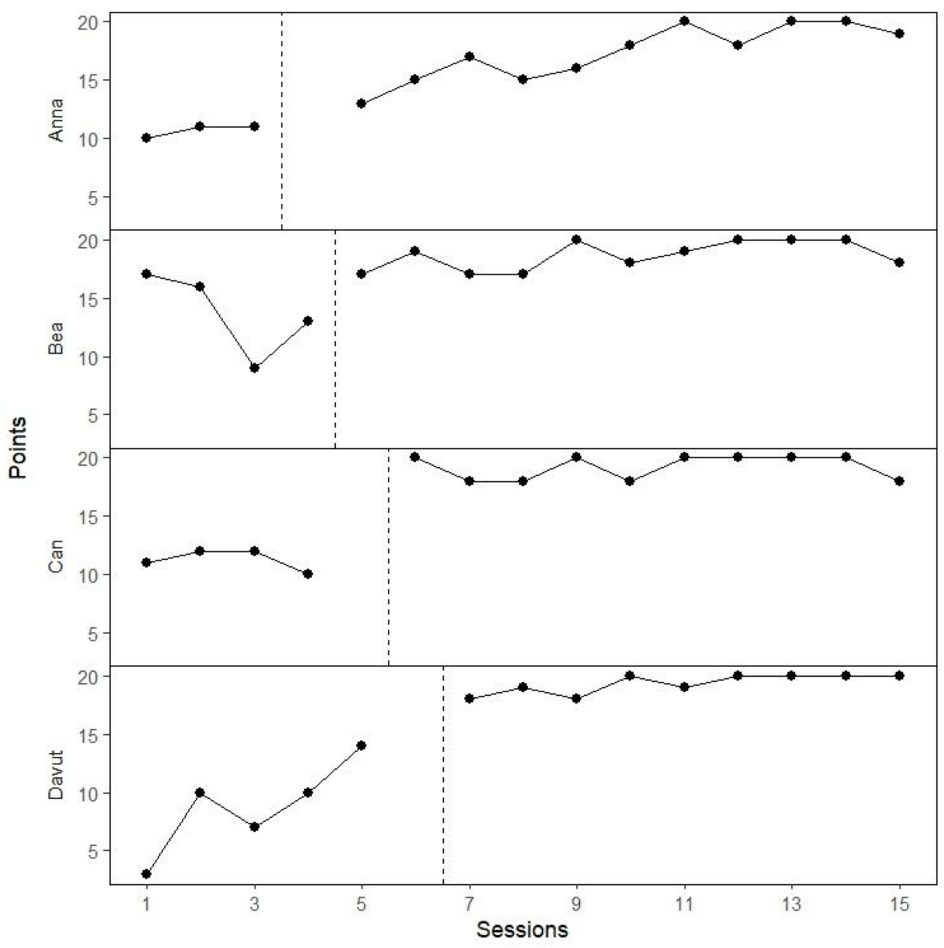

Figure 2. Individual Performance Trajectories for all Participants across Baseline and Intervention Phases

During baseline, Anna's scores were relatively stable at a moderate level, with limited variability and no systematic trend. Following the introduction of the intervention, her performance increased, primarily in the form of a modest level shift. Subsequent improvements were gradual and uneven, with scores approaching the upper range of the scale only toward the end of the intervention phase.

Bea's baseline performance was characterized by considerable variability and began at a comparatively high level, with an initial score of 17 out of 20. This limited the available range for improvement and raised concerns about ceiling effects. The subsequent decline in baseline scores suggests instability and makes it difficult to establish a clear pre-intervention performance level. Although her scores increased following the onset of the intervention, the largely flat trajectory during the intervention phase indicates maintenance rather than continued improvement.

Can's baseline scores were consistently moderate to high and showed little variability. Given this relatively elevated baseline, observed changes at the transition to intervention were constrained by limited headroom for growth. While a level increase was evident, performance quickly reached a plateau near the top of the scale.

Davut's baseline data showed an upward trend accompanied by moderate variability, indicating improvement already occurring prior to intervention. After the intervention was introduced, his performance increased further; however, this change must be interpreted in light of the positive baseline trend. His scores stabilized relatively quickly during the intervention phase, suggesting consolidation rather than sustained or accelerating improvement.

Across participants, baseline performance was heterogeneous, with differing levels, trends, and degrees of variability. Following the introduction of the intervention, higher overall scores were observed for all students; however, the magnitude and interpretability of these changes varied considerably and were influenced by baseline instability, pre-existing trends, ceiling effects, and early plateaus.

Descriptive statistics mirrored these patterns but should be interpreted cautiously. Mean scores increased from baseline to intervention for all participants (Anna: 10.67 to 17.36; Can: 11.25 to 19.20; Bea: 13.75 to 18.64; Davut: 8.80 to 19.33), alongside generally reduced variability during intervention phases. At the same time, baseline standard deviations varied widely (0.58 to 4.09), underscoring substantial differences in initial performance stability and limiting the comparability of change magnitudes across students.

Tau-U effect sizes adjusted for baseline trend ranged from moderate to moderately large (τ = .57-.78). Although these indices are consistent with observed level changes, they should not be interpreted as definitive indicators of strong intervention effects given the small sample size, heterogeneous baselines, limited number of data points, and the presence of ceiling effects for some participants.

Hierarchical piecewise linear modeling (HPLM) was not conducted. Given the short and uneven baselines, combined with abrupt level changes and rapid plateaus during the intervention phase, slope estimates would likely have been unstable and difficult to interpret. Under these conditions, visual inspection supported by Tau-U provides a conservative descriptive account of observed performance changes rather than a basis for strong causal claims.

Across all participants, social validity ratings indicated uniformly high acceptance of the OPBCI. On the four-point icon scale, all students selected the most positive response (“thumbs up”) for the categories of usefulness, clarity, and overall enjoyment, and three of the four did so for willingness to continue the program. In the short interviews, students described the visual organizer as “helpful”, “easy to remember”, and “making hard problems simpler”, noting that they particularly liked the clear step structure and the star-based reward system. Minor suggestions for improvement focused on including more colorful examples and additional space for writing, but no student expressed frustration or disengagement.

4. Discussion

4.1 Main Findings

In reference to the research questions outlined above, the present findings suggest that OPBCI was associated with improvements in students’ accuracy and use of structured solution steps when working on arithmetic word problems. Across the four participants, the introduction of the intervention coincided with higher performance levels relative to baseline, along with reduced within-phase variability; however, the magnitude and pattern of change varied across students and were, in some cases, constrained by baseline levels or ceiling effects. Tau-U effect sizes in the moderate to moderately large range (τ = .57-.78) were consistent with observed phase differences but should be interpreted cautiously given individual variability and baseline trends. At the individual level, Anna and Davut showed gradual increases across sessions, whereas Bea and Can reached higher performance levels early and subsequently maintained them. Although the staggered introduction of the intervention is compatible with experimental control, the small sample size and heterogeneous baselines warrant restrained conclusions regarding causal effects.

Social validity findings further underscored the intervention’s practicality and appeal: all students rated the OPBCI as useful, enjoyable, and easy to follow, noting that the visual organizer helped them make sense of difficult problems. Collectively, the results suggest that the OPBCI can effectively promote both procedural fluency and conceptual understanding of additive word problems among upper-elementary learners with and without learning difficulties.

4.2 Limitations

Several limitations should be considered when interpreting the present findings, particularly given the modest and heterogeneous patterns of change observed across participants. First, no follow-up assessment was conducted due to the upcoming school vacation, leaving questions of maintenance and generalization unresolved. It therefore remains unclear whether observed performance levels would be sustained over time or extend beyond the immediate instructional context. In addition, although the two graduate students who served as interventionists monitored each other's treatment fidelity, this arrangement did not provide fully independent verification of implementation integrity.

A second set of limitations concerns the scope and ecological validity of the study. The absence of generalization probes and systematic teacher ratings of social validity restricts conclusions about transfer to regular classroom instruction and perceived feasibility. Moreover, all sessions were conducted individually in a quiet resource room, and the relatively short intervention duration (9-11 sessions) combined with the narrow focus on additive word-problem types further limits inferences about robustness under typical classroom conditions or for more complex operations.

Finally, analytic considerations also warrant attention. Hierarchical Piecewise Linear Modeling (HPLM) was not applied because short and heterogeneous baselines, along with abrupt level changes and early plateaus, would likely have produced unstable and potentially misleading slope estimates. Accordingly, visual analysis supported by Tau-U was used as the primary descriptive approach. Nevertheless, the small number of participants, baseline trends for some students, and ceiling effects for others constrain the strength of causal interpretations.

Taken together, these limitations underscore the need for cautious interpretation and point to the importance of future replications that include longer observation periods, independent fidelity assessment, generalization measures, and classroom-based implementation trials to better delineate the potential and boundaries of OPBCI in inclusive educational settings.

4.3 Practical Implications

Despite the aforementioned limitations, the present findings have important practical value. Many students with and without identified learning disabilities struggle with the linguistic and organizational demands of arithmetic word problems, which often prevent them from demonstrating their true mathematical competence. The OPBCI provides a structured yet simple method that can help teachers and support professionals make these problem types more accessible by breaking them into explicit, manageable steps.

Because the graphic organizer and accompanying think-aloud routine can be taught within short, individualized, or small-group sessions, the approach aligns well with Tier-2 or targeted intervention frameworks commonly used in inclusive and Response-To-Intervention (RTI) models. Its emphasis on visual structure and consistent verbal cues also makes it adaptable for multilingual learners and students who benefit from reduced language load.

Beyond specialized settings, the OPBCI can be integrated into regular mathematics instruction as a brief strategy lesson or scaffold for students who have difficulty organizing quantitative information in text. By providing a concrete visual framework for "start-change–result" relations, it supports both conceptual understanding and procedural fluency—two central goals of mathematics instruction for learners with diverse support needs. Implementing such evidence-informed strategies can help teachers address a high-impact area of academic difficulty while fostering more equitable access to mathematical problem-solving in inclusive classrooms.

Importantly, the approach is equally relevant for students who exhibit emerging learning difficulties but have not been formally identified with LD, aligning with prevention-oriented frameworks that seek to strengthen early competencies and reduce later academic risk.

4.4 Conclusion

Taken together, the findings provide promising evidence that structured graphic-organizer instruction, such as OPBCI, can improve students' ability to analyze and solve arithmetic word problems. The consistent pattern of functional gains across participants suggests that even brief, well-structured interventions can meaningfully support learners who struggle with the linguistic and organizational demands of mathematics.

Further research should extend these initial results through classroom-based replications, follow-up assessments, and applications to more complex mathematical domains. Refining and scaling approaches like OPBCI may help address persistent gaps in mathematics learning by supporting the development of strategic, language-supported pathways to mathematical understanding for students with and without learning disabilities. Within inclusive classrooms that serve both identified and at-risk learners, such interventions may contribute to preventive efforts aimed at reducing learning disparities before they consolidate into formal disabilities.

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