ENHANCING STUDENT LEARNING

Enhancing Pupils' Problem-Solving Performance Through Math Manipulatives

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Abstract

Mathematics problem-solving is an essential skill that requires pupils to develop conceptual understanding, logical reasoning, and the ability to apply mathematical concepts in meaningful situations. This action research determined the effectiveness of math manipulatives in enhancing the problem-solving performance of Grade 2 pupils in a public elementary school in Ozamiz City during the school year 2025–2026. Using a single-group pretest–posttest design, the study involved 32 Grade 2 pupils selected through criterion purposive sampling. Researcher-made mathematical performance tests and structured lesson plans were used as instruments, while the mean, standard deviation, and paired sample t-test were utilized for data analysis. Findings revealed that pupils' performance before the implementation of math manipulatives was categorized as Did Not Meet Expectations, while after the implementation, performance improved to Outstanding. Results further showed a very highly significant difference between the pretest and posttest scores, indicating that math manipulatives significantly enhanced pupils' problem-solving performance in Mathematics. The study conclude that concrete and hands-on learning materials improve pupils' conceptual understanding, reasoning skills, and engagement in Mathematics. The study recommends that Grade 2 mathematics teachers incorporate manipulatives, including counters, blocks, number lines, and fraction strips, into daily learner-centered instruction. Additionally, school administrators should ensure the provision of sufficient instructional materials and offer training on the effective use of these resources.

Keywords: Grade 2 Pupils; Hands-on Learning; Mathematics Instruction; Math Manipulatives; Problem-Solving Performance

1 Introduction

1.1 Context and rationale

Developing strong foundational mathematics skills among early-grade learners is globally recognized as essential for long-term academic success, particularly in cultivating conceptual understanding, reasoning, and problem-solving competence. International research emphasizes that young pupils learn mathematical ideas more effectively when they encounter concepts first through concrete, hands-on experiences before shifting to symbolic forms (Byrne et al., 2023). The increasing emphasis on learner-centered pedagogies worldwide has elevated the importance of manipulatives in early mathematics instruction, as these tools help bridge the cognitive transition from concrete to abstract thinking (Gilligan-Lee et al., 2023). When used strategically, manipulatives promote exploration, enhance understanding, and encourage active engagement key components for developing robust problem-solving abilities in the primary grades

In the Philippine educational context, the Department of Education's K–12 curriculum affirms the need for concrete–pictorial–abstract (CPA) sequences to strengthen numeracy among early learners.

Yet, national assessments reveal that many Filipino pupils continue to struggle with tasks requiring conceptual reasoning and multi-step problem solving. Local and international studies consistently show that learners demonstrate greater motivation, confidence, and comprehension when manipulatives are purposefully incorporated during instruction, especially among children who rely heavily on tactile and visual representations while forming new mathematical ideas (Gnawali, 2025). These insights are highly relevant for Grade 2 learners, who are expected to articulate reasoning, select appropriate strategies, and explain solutions during guided practice and classroom recitations (Angco and Angco, 2024). When manipulatives are used consistently, they support learners in expressing and testing ideas, reduce anxiety, and improve readiness for higher-level problem-solving tasks (Laski et al., 2023).

Despite these benefits, challenges in implementation persist. Teachers often report inconsistent access to materials, limited training in manipulative-based pedagogy, and uncertainty about how to meaningfully connect hands-on exploration to symbolic mathematics. When transitions from concrete to abstract stages are not strategically designed, pupils may develop misconceptions or remain dependent on materials without internalizing the underlying concepts (Byrne et al., 2023). This underscores the need for structured and intentional integration of manipulatives in early-grade classrooms to ensure that learners not only engage with materials but also translate these experiences into improved problem-solving performance.

There appears to be an empirical gap in the prior research, as limited rigorous studies have directly examined the effectiveness of hands-on manipulatives in improving problem-solving performance among early-grade learners. While existing literature highlights the value of manipulatives in supporting conceptual understanding, most studies have focused on teachers' perceptions, classroom implementation, and general learning experiences rather than directly measuring their impact on pupils' computation and problem-solving performance (Carbonneau et al., 2013). This suggests a need for further empirical investigation on how manipulatives influence early mathematical learning, particularly in addressing misconceptions in actual classroom settings (Laski et al., 2016)

In many public schools in Mindanao, including Ozamiz City, teachers face challenges in providing problem-solving instruction that is both developmentally appropriate and cognitively accessible to Grade 2 learners. Limited resources, large class sizes, and reliance on teacher-centered methods often result in minimal opportunities for pupils to manipulate concrete models or visually represent their thinking. Evidence indicates that when manipulatives are inconsistently or superficially introduced, learners struggle to develop the reasoning needed for accurate problem solving, particularly during recitations and independent tasks (Byrne et al., 2023). Research further emphasizes that effective, content-valid manipulative use depends heavily on teacher preparation and intentional instructional design (Angco and Angco, 2024). These local realities highlight the pressing need to empirically examine how hands-on manipulatives can be systematically used to improve problem-solving performance among Grade 2 pupils within the specific instructional context of Ozamiz City Central School.

This study aims to determine the effectiveness of hands-on manipulatives as an instructional intervention to enhance Grade 2 pupils' problem-solving performance. Grounded in evidence-based principles of concrete learning, the study seeks to examine whether structured manipulative-based activities improve pupils' reasoning, strategy use, and accuracy during problem-solving tasks—competencies that align with Grade 2 mathematics standards (Laski et al., 2023). By implementing a systematic, content-valid intervention grounded in established pedagogical research, this study

addresses the documented need for actionable, classroom-based evidence on manipulative effectiveness in early grades.

The study offers several contributions. Theoretically, it reinforces cognitive frameworks suggesting that knowledge construction and conceptual understanding deepen when children interact physically with mathematical representations (Gilligan-Lee et al., 2023). Empirically, it fills a critical gap by providing measurable, classroom-based findings on how manipulatives influence Grade 2 pupils' problem-solving outcomes, an area with limited prior research (Miles, 2017). Methodologically, the study strengthens content validity by modeling a structured, replicable intervention aligned with research-backed manipulative practices (Rowly, 2020). Practically, the results can guide teachers in adopting low-cost, developmentally appropriate strategies that reduce misconceptions, enhance engagement, and improve pupils' confidence and performance in mathematical problem solving (Gnawali, 2025).

1.2 Intervention

This study implemented math manipulatives as an instructional intervention designed to enhance Grade 2 pupils' problem-solving performance in mathematics. The intervention involved the systematic integration of concrete learning materials such as counters, unit blocks, number tiles, and pictorial models during problem-solving activities across the instructional period. These manipulatives were used not merely as supplementary tools but as core components of the lesson sequence, guiding pupils through a structured concrete–pictorial–abstract (CPA) progression.

The intervention gave pupils the chance to physically model problems, test solution pathways, visualize number relationships, and articulate their reasoning during guided and independent tasks. It was based on research demonstrating that concrete materials deepen conceptual understanding, support strategic reasoning, and improve mathematical accuracy among young learners (Ahmad and Siller, 2024). Through consistent, intentional use of manipulatives, the intervention aimed to strengthen learners' ability to analyze problems, choose appropriate strategies, and represent solutions with clarity and accuracy.

The intervention was designed to address the documented instructional gap in early mathematics education, particularly the lack of structured manipulative-based approaches that help learners transition from concrete exploration to abstract problem solving (Byrne et al., 2023; Tjandra, 2023). By implementing a content-valid, evidence-aligned manipulative sequence, this study sought to determine whether such an approach could produce measurable improvements in Grade 2 pupils' problem-solving performance within the context of Ozamiz City Central School.

1.3 Statement of the problem

This study aimed to enhance pupils' performance in basic mathematical operations through math manipulatives during the school year 2025–2026 in one of the public elementary schools in Ozamiz City. Specifically, it sought to answer the following questions:

1. What is the level of pupils' problem-solving performance before the implementation of the math manipulatives?
2. What is the level of pupils' problem-solving performance after the implementation of the math manipulatives?
3. Is there a significant difference in the levels of pupils' problem-solving performance before and after the implementation of the math manipulatives?

1.4 Null hypotheses

H01: There is no significant difference in the level of pupils' problem-solving performance before and after the implementation of the math manipulatives.

2 Research methodology

2.1 Research design

This study employed a classroom-based action research approach using a single pretest–posttest design. A pretest–posttest design strategy administered a pretest before the intervention and evaluated learning gains through a posttest afterward (Marcos et al., 2024). The strategy involved the systematic use of hands-on manipulatives during mathematics sessions, enabling pupils to model operations, represent quantities, and explore number relationships through concrete manipulation. Given the limited class size, this design allowed analysis within the same group without requiring a control group, and the comparison of pretest and posttest scores determined how the strategy enhanced pupils' accuracy and understanding in solving basic mathematical problems.

2.2 Research setting

This study was conducted in one of the elementary schools in Ozamiz City, Misamis Occidental, Philippines. The school offered complete elementary education, including Grade 2. The research focused on Grade 2 pupils enrolled in mathematics, which introduced foundational numeracy skills such as addition, subtraction, and simple problem-solving. The school maintained a positive learning environment with well-ventilated classrooms, sufficient facilities, and a calm community setting that supported pupils' concentration and overall well-being. Its team of licensed and committed teachers employed varied instructional approaches to strengthen learners' foundational skills, especially in early numeracy. With pupils coming from different socio-economic backgrounds, the school served as a suitable setting for exploring how manipulative-based strategies, such as hands-on counters, could improve learners' comprehension and performance in basic mathematical operations.

2.3 Participants of the study

This study involved thirty-three (33) Grade 2 pupils enrolled in one of the public elementary schools in Ozamiz City, Misamis Occidental, Philippines, for the S.Y. 2025–2026. Participants were selected through criterion purposive sampling. The criteria for inclusion were as follows: (1) pupils were officially enrolled in the identified Grade 2 class at the time of the study, and (2) pupils provided voluntary assent, ensuring that the respondents appropriately represented the target group whose problem-solving performance was expected to improve through the use of hands-on manipulatives.

2.4 Instrument

The research instruments used in this study are the following:

A. Mathematical Performance Test Questionnaire (Appendix A). A researcher-made Mathematical Performance Test was administered to determine the pupils' problem-solving performance. The test was conducted both before and after the use of math manipulatives to assess improvements in their ability to solve mathematical problems. The test was administered to the selected Grade 2 class over a series of structured sessions. Each meeting began with a short pretest, followed by the teaching session where manipulatives were used as part of the hands-on strategy, and ended with a posttest to

measure immediate learning gains. The assessment consisted of items on unit fractions and common fractions, focusing on accuracy, conceptual understanding, and the ability to model operations using concrete representations. A 30-point scoring guide was used to evaluate pupils' performance. For interpretation, the study adapted the hypothetical mean range and descriptive equivalents from DepEd Order No. 8, s. 2015.

Table 1. Scoring scale of the Mathematical Performance Test.

Score Range	Interpretation
27–30	Outstanding
24–26	Very Satisfactory
21–23	Satisfactory
18–20	Fairly Satisfactory
1–17	Did Not Meet Expectations

B. Lesson Plans (Appendix B). The lesson plans outlined the structured integration of math manipulatives during mathematics instruction. Each session followed a sequence that included a pretest, guided demonstrations using manipulatives, interactive problem-solving activities, and a posttest to evaluate learning progress. Activities were designed to help pupils visualize mathematical problems, group quantities, and model number sentences using manipulatives. The consistent use of these lesson plans ensured uniform implementation of the intervention throughout the study.

Content validity was confirmed through expert evaluation, construct validity through pilot testing, and reliability through Cronbach's alpha.

Through these instruments, the study comprehensively assessed how the hands-on manipulative intervention supported pupils' engagement and improved their performance in problem-solving.

2.5 Data collection

Prior to data collection, the researcher secured formal approval to conduct the study by submitting request letters to the appropriate authorities, including the Dean of the College, the Schools Division Superintendent, and the School Principal of the selected elementary school in Ozamiz City. Upon approval from the Superintendent and the Principal, subsequent letters were addressed to the ELC Coordinator and the Cooperating Teacher, and their consent was obtained prior to the implementation of any data collection procedures. Each letter clearly outlined the objectives, methodology, and scope of the study to ensure transparency and adherence to institutional and ethical guidelines. Following the approval process, informed consent forms were distributed to the parents or guardians of the Grade 2 pupils, together with assent forms for the pupils, to ensure voluntary and ethical participation.

Data collection focused on enhancing pupils' problem-solving performance through math manipulatives. Sessions were conducted over a series of lessons, with each session beginning with a pretest to assess pupils' prior knowledge and skills in mathematical problems. This was followed by teacher-guided activities using hands-on manipulatives to model problem-solving. Each session concluded with a post-test to evaluate immediate learning outcomes. While the format of the pretests and post-tests remained consistent, the content varied according to the specific objectives of each session.

In addition to the assessments conducted during each session, a pre-assessment questionnaire and performance test were administered prior to the first session to establish baseline levels of pupils' mathematical skills and performance. Following the final session, a post-assessment was conducted to determine overall improvement. The mean scores from the pretests and post-tests were analyzed to identify changes in pupils' problem-solving performance. A standardized scoring rubric was applied to ensure consistent, objective, and reliable measurement of pupils' progress throughout the implementation of the hands-on manipulatives.

2.6 Ethical considerations

Before conducting the study, ethical considerations were carefully established to prioritize the well-being, rights, and privacy of all participants. Approval was sought from the Misamis University Research Ethics Board (MUREB) to ensure compliance with institutional and ethical research standards. Approval to conduct the study was also sought from the School Principal, the Grade Level Head, and the class Adviser, with each authority's consent obtained prior to any data collection. These approvals confirmed that the study complied with institutional and research guidelines. Informed consent procedures were implemented for all participants. Parents or guardians of the selected Grade 2 pupils provided formal consent, and the pupils themselves gave assent, indicating their voluntary participation. Participants were fully informed of the study's objectives, procedures, potential benefits, and possible risks, and they were given the option to withdraw at any time without negative consequences.

Confidentiality and anonymity were maintained throughout the study. All data excluded personally identifiable information, and participants were assigned coded identifiers. Digital data were encrypted, and physical documents were securely stored in a locked cabinet accessible only to the researcher. These procedures complied with Republic Act No. 10173 (Data Privacy Act of 2012), ensuring participants' privacy, security, and dignity.

The study was conducted in a safe and supportive learning environment to minimize risks and prevent harm. Activities involving the use of hands-on manipulatives were carefully guided and monitored to avoid any physical, psychological, or emotional distress. By adhering to these ethical standards, the researcher protected participants' welfare while maintaining the credibility and integrity of the study.

2.7 Data analysis

This study utilized the following statistical tools for data analysis using JAMOVI software:

- The mean and standard deviation were calculated to determine the overall performance of Grade 2 pupils in problem-solving performance before and after implementing the math manipulatives.
- A paired sample t-test was conducted to examine whether there was a significant difference in pupils' performance before and after using the math manipulatives.

2.8 Dissemination plan

The study's findings were shared with school administrators, cooperating teachers, and Grade 2 pupils and parents through reports, discussions, and simple summaries to help stakeholders understand the benefits of math manipulatives. Consent and assent procedures were highlighted when sharing results with pupils and parents to emphasize ethical research practices. The findings

were also presented to the university community and other educators through seminars, presentations, and publications to support improved teaching strategies.

2.9 Utilization plan

The results of the study will be utilized through Poster Presentation and Publication. A poster summarizing the key findings, conclusions, and recommendations will be prepared and displayed during academic or research dissemination events. This will allow educators, school stakeholders, and other researchers to easily understand the study's outcomes and apply its insights. Additionally, the study will be prepared for publication in an academic journal or institutional research repository, ensuring that its contributions reach a wider audience and support further research on strengthening pupils problem-solving performance through math manipulatives.

2.10 Cost estimates

The estimated budget in the conduct of this study is broken down below from the personal money of the proponent. The proponent has a personal laptop and printer.

Table 2. Estimated cost of the study.

Materials	Amount
1 ream A4 US bond paper	Php 180.00
1 set GT53 ink	Php 1,150.00
Manipulative materials	Php 1,500.00
Tokens (pencil)	Php 700.00
Snacks	Php 1,000.00
Total	**Php 4,530.00**

3 Results and discussion

3.1 Level of pupils' problem-solving performance before the implementation of the math manipulatives

Table 3 presents the level of pupils' problem-solving performance before the implementation of the math manipulatives. Overall, the pupils' performance was categorized as Did Not Meet Expectations, with a mean score of M = 16.8 (SD = 1.15). This finding suggests that the pupils had limited mastery of mathematical problem-solving skills before the implementation of the intervention. The result indicates the need for more engaging and appropriate instructional strategies, such as the use of math manipulatives, to improve pupils' understanding and performance in Mathematics.

Among the performance levels, the highest proportion of pupils fell under the Did Not Meet Expectations category (n = 25, 78.1%, M = 15.5, SD = 1.96). This was followed by pupils who obtained a Fairly Satisfactory performance level (n = 7, 21.9%, M = 18.1, SD = 0.34). No pupils were categorized as Satisfactory, Very Satisfactory, or Outstanding before the implementation of the math manipulatives.

The findings indicate that most pupils demonstrated limited understanding and mastery of mathematical concepts and problem-solving strategies before the use of manipulatives. The large proportion of pupils in the Did Not Meet Expectations category suggests that many struggled to solve mathemat-

ical problems when taught solely with traditional instructional approaches. Only a few pupils achieved a Fairly Satisfactory level, implying that the existing teaching approaches may not have sufficiently addressed the pupils' diverse learning needs. This pattern highlights gaps in conceptual understanding and analytical thinking, particularly among elementary learners, who generally benefit from concrete, visual learning experiences.

The findings are supported by several studies that emphasized the importance of manipulative-based instruction in improving pupils' mathematical understanding and problem-solving skills. The use of manipulatives significantly enhanced pupils' mathematical comprehension and performance by enabling tactile and visual learning experiences (Lacaba, 2025). Similarly et al. (2009) explained that concrete manipulatives help learners visualize abstract mathematical concepts and strengthen conceptual understanding. Pupils exposed to manipulatively based instruction also demonstrated better numeracy skills and mathematical achievement than those who received traditional teaching methods (Vendicacion et al., 2025).

Moreover, discovery-based learning using physical manipulatives improved pupils' performance in solving complex mathematical problems and enhanced retention of mathematical concepts (Milenković et al., 2025). Likewise, effective mathematics instruction that integrates manipulatives, visualizations, and active learning activities helps strengthen conceptual understanding and procedural fluency among elementary learners (Bognar et al., 2025). These studies support the present findings that the absence of interactive, concrete learning experiences may contribute to pupils' low mathematics performance prior to the intervention.

The findings imply the need for instructional improvement among teachers and school administrators. Teachers may integrate math manipulatives such as counters, blocks, number lines, fraction strips, and other concrete materials into classroom instruction to make Mathematics lessons more interactive and meaningful. School heads may also provide instructional resources and training workshops focused on the effective use of manipulatives in teaching Mathematics. Furthermore, activities such as guided hands-on exercises, collaborative problem-solving tasks, and visual representation activities may help pupils better understand mathematical concepts and improve their problem-solving performance.

Table 3. Level of pupils' problem-solving performance before the implementation of the math manipulatives.

Performance	Frequency	Percentage	M	SD
Fairly Satisfactory	7	21.9	18.1	0.34
Did Not Meet Expectations	25	78.1	15.5	1.96
Overall Performance	32	100.00	16.8	1.15

Note: 27-30 (Outstanding); 24-26 Very Satisfactory); 21-23 (Satisfactory); 18-20 (Fairly Satisfactory); 1-17 (Did Not Meet Expectations)

3.2 Level of pupils' problem-solving performance after the implementation of the math manipulatives

Table 4 presents the level of pupils' problem-solving performance after the implementation of the math manipulatives. Overall, the pupils' performance was at the Outstanding level, with a mean score of M = 27.2 (SD = 1.04). This finding suggests that the pupils demonstrated a high level of mastery in mathematical problem-solving skills after being exposed to the intervention. The result indicates that

the use of math manipulatives contributed positively to pupils' understanding and performance in Mathematics.

Among the performance levels, the highest proportion of pupils obtained an Outstanding performance rating (n = 20, 62.5%, M = 28.8, SD = 1.28). This was followed by pupils who achieved a Very Satisfactory performance level (n = 12, 37.5%, M = 25.6, SD = 0.79). No pupils were categorized as Satisfactory, Fairly Satisfactory, or Did Not Meet Expectations after the implementation of the math manipulatives.

The findings indicate that the implementation of math manipulatives positively influenced the pupils' problem-solving performance in Mathematics. The high overall mean suggests that most pupils were able to understand and apply mathematical concepts effectively after being exposed to concrete and hands-on learning experiences. The high percentage of pupils who achieved an Outstanding rating further suggests that manipulatives improved pupils' comprehension, analytical thinking, and confidence in solving mathematical problems.

Moreover, the absence of pupils in the lower performance categories may indicate that the intervention effectively addressed pupils' learning difficulties and enhanced their mathematical understanding. Since elementary pupils learn more effectively through concrete and visual activities, the use of manipulatives may have provided meaningful learning experiences that strengthened their academic performance.

The findings revealed that math manipulatives were effective in improving pupils' mathematical performance and conceptual understanding. Pupils who were taught using manipulatively based instruction demonstrated better mathematical reasoning and problem-solving abilities than those who received conventional instruction (Lacaba, 2025). The use of manipulatives also significantly enhanced pupils' numeracy skills by allowing them to understand concepts through concrete and visual learning experiences (Vendicacion et al., 2025). Moreover, manipulative-based activities improved pupils' mathematical performance, reasoning skills, and retention of concepts through hands-on exploration and discovery learning (Milenković et al., 2025). Similarly, pupils exposed to manipulative-based instruction showed significantly higher mathematical achievement and conceptual understanding after the intervention (Ramiati et al., 2025). These studies support the present findings that math manipulatives are effective instructional tools in improving pupils' mathematics achievement and problem-solving performance.

The findings imply that teachers and school administrators may continuously integrate math manipulatives into Mathematics instruction, particularly in the elementary grades, to sustain pupils' high academic performance and conceptual understanding. Teachers may also develop more learner-centered, interactive activities that use concrete materials, visual aids, and guided problem-solving exercises to maintain pupils' engagement and participation during Mathematics lessons. School administrators may support the implementation of manipulative-based instruction by providing adequate instructional materials and conducting professional development programs for teachers. Furthermore, parents may be encouraged to reinforce pupils' learning at home through simple, hands-on mathematical activities that strengthen pupils' problem-solving skills and confidence in Mathematics.

Table 4. Level of pupils' problem-solving performance after the implementation of the math manipulatives.

Performance	Frequency	Percentage	M	SD
Outstanding	20	62.5	28.8	1.28
Very Satisfactory	12	37.5	25.6	0.79
Overall Performance	32	100.00	27.2	1.04

Note: 27-30 (Outstanding); 24-26 Very Satisfactory); 21-23 (Satisfactory); 18-20 (Fairly Satisfactory); 1-17 (Did Not Meet Expectations)

3.3 Significant difference in the levels of pupils' problem-solving performance before and after the implementation of the math manipulatives

Table 5 presents the significant difference in pupils' problem-solving performance before and after the implementation of math manipulatives. The results showed a very highly significant difference in the pupils' problem-solving performance, as indicated by the computed t-value and p-value ($t = 24.6$, $p = 0.001$). This led to the rejection of the null hypothesis (H_{01}). The mean score of the pupils increased from before the implementation ($M = 16.1$, $SD = 2.06$) to after the implementation ($M = 27.6$, $SD = 1.93$), indicating a substantial improvement in pupils' problem-solving performance.

The significant result suggests that the use of math manipulatives had a strong positive effect on the pupils' problem-solving performance in Mathematics. The notable increase in mean scores suggests that pupils were better able to understand and solve mathematical problems when they were exposed to concrete, hands-on learning experiences. Through the use of manipulatives, pupils may have developed deeper conceptual understanding, improved reasoning skills, and enhanced confidence in solving mathematical tasks. Moreover, the lower standard deviation after the implementation indicates more consistent performance among the pupils, suggesting that the intervention helped minimize learning gaps and supported both struggling and advanced learners. Since elementary pupils learn more effectively through active participation and visual representation, the use of manipulatives may have provided meaningful learning experiences that strengthened pupils' mathematical understanding and problem-solving abilities.

The findings revealed that manipulative-based instruction significantly improved pupils' mathematical performance and conceptual understanding. Manipulatives enhanced pupils' numeracy skills, reasoning abilities, and engagement in Mathematics activities by allowing learners to visualize and concretely experience mathematical concepts (Vendicacion et al., 2025). Similarly, pupils exposed to hands-on learning activities demonstrated higher achievement and improved problem-solving skills compared to those taught using traditional teaching methods (Lacaba, 2025). Moreover, discovery-based learning using manipulatives improved pupils' mathematical reasoning, retention, and overall academic performance in Mathematics (Milenković et al., 2025). These studies support the present findings that math manipulatives are effective instructional tools in enhancing pupils' mathematical performance and problem-solving skills.

The findings imply that teachers and school administrators may continuously integrate math manipulatives into Mathematics instruction, particularly in the elementary grades, to strengthen pupils' conceptual understanding and problem-solving performance. Teachers may develop more learner-centered and interactive classroom activities using concrete objects such as counters, blocks, fraction strips, number lines, and other visual materials to sustain pupils' participation and engagement during Mathematics lessons. School administrators may also provide instructional resources and conduct training workshops on the effective use of manipulatives in teaching Mathematics. Further-

more, parents may be encouraged to reinforce pupils' learning at home through simple hands-on mathematical activities that can help improve pupils' confidence and understanding in solving mathematical problems.

Table 5. Significant difference in the levels of pupils' problem-solving performance before and after the implementation of the math manipulatives.

Performance	M	SD	T-value	P-value	Decision
Before the Implementation of the Math Manipulatives	16.1	2.06	24.6***	0.001	Reject H_{01}
After the Implementation of the Math Manipulatives	27.6	1.93			

Note: ***p<0.01 (Very Highly Significant); **p<0.01 (Highly Significant); *p<0.05 (Significant)

4 Summary, findings, conclusions and recommendations

4.1 Summary

This study aimed to determine the effectiveness of math manipulatives in improving the problem-solving performance of Grade 2 pupils in one of the public elementary schools in Ozamiz City during the school year 2025–2026. Specifically, it examined the level of pupils' problem-solving performance before and after the implementation of the math manipulatives and the significant difference in the levels of pupils' problem-solving performance before and after the implementation of the intervention. The study focused on Grade 2 pupils to determine how the use of math manipulatives influences pupils' conceptual understanding, engagement, and problem-solving performance in Mathematics.

4.2 Findings

This study yielded the following findings:

1. The level of Grade 2 pupils' problem-solving performance before the implementation of the math manipulatives was fairly satisfactory.
2. The level of Grade 2 pupils' problem-solving performance after the implementation of the math manipulatives was outstanding.
3. There was a very highly significant difference in the pupils' problem-solving performance before and after the implementation of the math manipulatives.

4.3 Conclusion

Based on the findings of the study, the following are the conclusions:

1. Grade 2 pupils demonstrate low problem-solving performance in Mathematics before the implementation of math manipulatives.
2. Grade 2 pupils achieve outstanding problem-solving performance after exposure to math manipulatives.
3. The implementation of math manipulatives significantly improves pupils' problem-solving performance in Mathematics.

4.4 Recommendations

Based on the findings and conclusions of the study, it is recommended that:

1. Grade 2 Mathematics teachers integrate math manipulatives such as counters, blocks, number lines, and fraction strips into daily classroom instruction through hands-on and learner-centered activities to improve pupils' problem-solving performance.
2. School administrators provide adequate instructional materials and conduct training programs and workshops that enhance teachers' knowledge and skills in the effective use of math manipulatives in Mathematics instruction.
3. Future researchers conduct similar studies using other mathematical competencies, grade levels, or larger groups of participants to further validate the effectiveness of math manipulatives in improving pupils' mathematics performance.

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