

# Conceptual Understanding Intervention for Learners Struggling in Mathematics

**DIANA A. CARRANZA**

Luciente II National High School  
diana.carranza@deped.gov.ph

**ANA PERLA B. DE GUZMAN**

Benigno V. Aldana National High School

*Abstract* — This study dealt on the conceptual understanding intervention for struggling learners in mathematics at Sampaloc National High School, Division of Pangasinan I, during the S.Y. 2024-2025. Utilizing a quasi-experimental research design, specifically the pretest-posttest design, the study involved 30 Grade 7 learners identified as having difficulties in basic numeracy skills. The aim was to assess the effectiveness of conceptual understanding interventions designed to enhance learners' understanding and performance in mathematics.

Findings showed a significant improvement in learner performance, with the mean score rising from 11.23 (pretest) to 23.07 (post-test). Statistical analysis using a paired samples t-test revealed a significant difference ( $p < 0.001$ ), indicating that the intervention positively impacted the learners learning. However, despite the overall progress, some learners still struggled, highlighting the need for further targeted support. Based on these findings, the study recommends the implementation of an action plan, Project COUNT, to address the numeracy gaps of struggling learners, along with continuous formative assessments, the integration of technology-based tools, and further research into additional conceptual understanding strategies.

*Keywords* — *conceptual understanding, intervention, pretest, posttest*

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## I. Introduction

The evolving landscape of education presents a significant challenge to mathematics teaching, particularly in secondary schools. As the demands of the modern educational system continue to increase, mathematics teachers continuously seek innovative and practical strategies to help learners improve their mathematical knowledge and performance. These strategies support learners' development by enabling them to build knowledge and cognitive skills, learn through problem-solving, and gain situational understanding. Mathematics education, therefore, requires an ongoing search for the most effective methods to foster learner learning and achievement (McNelles et al., 2020).

The Philippines, in particular, faces significant challenges regarding learners' mathematical competencies. According to the Programme for International Learner Assessment (PISA). According to the latest PISA results from 2022, the Philippines has fallen significantly behind in science, mathematics, and reading. In mathematics, the country ranked sixth from the

bottom, achieving an average score of 355 (Montemayor, 2023). These results underscore the need for substantial improvements in learners' mathematical abilities and reflect the ongoing educational gaps that must be addressed in the Philippines (Magsambol, 2020).

The struggle of Filipino learners in mathematics is not just a matter of academic performance but also reflects broader issues such as poor attitudes towards the subject.

To address these challenges, the Department of Education (DepEd) in the Philippines has implemented various interventions to improve the mathematical literacy of learners, especially those struggling to grasp basic mathematical concepts. These efforts align with the Philippine Constitution's mandate to provide quality education and ensure access to basic education that meets international standards, as outlined in Article XIV, Sections 1 and 2 of the 1987 Constitution. These provisions guide DepEd's ongoing efforts to enhance the quality of mathematics education in the country through comprehensive reforms and targeted interventions.

However, despite the proven success of these strategies in various educational contexts, there remain instances where such interventions fall short—highlighting the importance of continuous evaluation and adaptation to local learner needs. In Sampaloc National High School, located in the District of Bolinao I, Division of Pangasinan I, 30 Grade 7 learners have been identified as struggling in mathematics. These learners consistently perform poorly on standardized tests and classroom assessments, struggling with fundamental mathematical operations, problem-solving skills, and conceptual understanding—skills crucial for success in more advanced mathematics.

This persistent issue calls for further investigation into the effectiveness of these interventions. As such, this study aims to assess the various interventions implemented by mathematics teachers to enhance learners' mathematical performance, mainly focusing on their ability to master fundamental mathematical concepts. The study will evaluate the efficiency of these interventions in helping learners overcome the challenges they face in developing essential mathematical skills and ultimately improving their academic achievement.

### **Statement of the Problem**

This study aimed to determine the effectiveness of conceptual understanding intervention for learners struggling in mathematics in Sampaloc National High School, Schools Division Office of Pangasinan I, S.Y. 2024-2025.

Specifically, it sought to answer the following problems:

1. What is the performance of the grade 7 learners before and after the implementation of conceptual understanding intervention for learners struggling in mathematics?

2. Is there a significant difference between the performance of the learners before and after the implementation of the conceptual understanding intervention for learners struggling in mathematics?
3. What plan of action can be proposed to improve the performance of the learners struggling in mathematics?

### **Literature Review**

Mathematics is widely regarded as a fundamental component of education, playing a crucial role in the development of scientific knowledge, technological advancement, and economic growth. It nurtures logical reasoning, critical thinking, and problem-solving skills that are essential for learners to thrive academically and professionally. However, despite its recognized importance, Filipino students consistently underperform in mathematics, as evidenced by international large-scale assessments. Similarly, the 2019 Trends in International Mathematics and Science Study (TIMSS) showed that Filipino Grade 4 students scored the lowest in mathematics among 58 countries (IEA, 2020).

This low performance can be attributed to several interrelated factors, including insufficient teaching materials, poor learning environments, negative learner attitudes, and ineffective instructional approaches. Many students struggle to connect mathematical concepts to real-life contexts, and often experience anxiety and lack of motivation.

Struggling learners in mathematics encompass a diverse group, including those with specific learning disabilities such as dyscalculia, and others with language-based disorders like dyslexia and dysgraphia. These conditions hinder their ability to process numbers, understand mathematical vocabulary, and recognize symbols, ultimately affecting comprehension and computation (Butterworth et al., 2021). Additionally, math anxiety—a psychological barrier characterized by feelings of tension and fear—significantly contributes to poor performance. Studies have found that learners with high levels of math anxiety tend to avoid mathematical tasks, which further impedes their skill development (Ramirez et al., 2022).

Given these challenges, effective intervention and instructional strategies are essential. Early and targeted interventions can significantly improve the academic trajectory of struggling learners. Research supports the use of evidence-based approaches such as mastery learning, which ensures that students achieve competency in foundational topics before moving forward (Guskey, 2021). Constructivist strategies that promote active learning, peer collaboration, and real-world applications have also shown promise in enhancing students' engagement and understanding.

## II. Methodology

### Research Design

For this study, the researcher utilized a quasi-experimental research design, specifically the pretest-posttest design. The pretest-posttest design was a widely used method to assess the effects of a treatment or intervention on a group of individuals. This design involved two key measurement points: one before the treatment (pretest) and one after the treatment (posttest). The primary purpose of this approach was to evaluate any changes in the participants' performance or behavior as a result of the intervention. The pretest served as a baseline measurement, while the posttest helped to identify any differences or improvements after the intervention had been applied. This method was commonly used in experimental and quasi-experimental research and could be employed with or without control groups, depending on the study's structure (Bobbitt, 2020).

This research design's general process involved administering a pretest to the participants to assess their initial state or performance. The treatment or intervention was implemented, and finally, a posttest was administered to determine whether any changes occurred in the participants' outcomes. The data from the pretest and posttest were then analyzed and compared to evaluate the impact of the treatment. This approach was particularly valuable in research aiming to assess the effectiveness of specific interventions and their direct effects on the participants.

In the context of this study, the researcher employed the pretest-posttest design to examine the effects of intervention strategies on the conceptual understanding of struggling learners in mathematics. The researcher sought to determine whether these strategies had a measurable impact on improving the learners' comprehension and overall academic performance. Ultimately, this research design offered a structured and effective way to analyze the impact of educational interventions, providing data that could guide future instructional practices and support the academic success of struggling learners.

### Population and Locale of the Study

The study participants comprised 30 identified Grade 7 struggling mathematics learners from Sampaloc National High School. These learners were selected based on their performance in fundamental numeracy skills, the building blocks for mathematical understanding. The learners struggled to grasp basic mathematical concepts, resulting in low academic achievement. In addition, they exhibited lack of confidence and interest in mathematics, which further hindered their progress.

These challenges highlight a need for interventions and additional support to improve their numeracy proficiency. Despite their current struggles, these learners show the potential for growth and academic improvement. With the application of conceptual understanding interventions such as video presentations, worksheets, and one-on-one tutoring, these learners can develop a stronger foundation in mathematics. The study sought to determine the effectiveness of such interventions

in enhancing their numeracy proficiency, thereby improving their overall performance in mathematics.

### **Data Gathering Tool**

This study adopted a division-wide tool from the SDO Pangasinan I Division designed to assess the conceptual understanding of struggling learners in mathematics as a data-gathering instrument. The test was divided into two parts: a pretest and a posttest. The pretest included questions covering key concepts and skills identified as challenging for struggling learners. These questions were designed to gauge the learners' initial understanding and identify specific areas of difficulty. The posttest contained similar questions to the pretest but will assess the learners' understanding after implementing the conceptual understanding intervention strategies.

### **Data Gathering Procedure**

The data-gathering procedure for this study began with selecting participants from Grade 7 learners who were identified as struggling learners in mathematics based on their performance in basic numeracy skills. Consent was obtained from the learners and their parents or guardians before participation.

The first data collection phase involved administering a pretest to assess the learners' baseline understanding of key mathematical concepts. The administration of the pretest served as a critical component in assessing the initial proficiency of the selected 30 Grade 7 learners at Sampaloc National High School, who had been identified as struggling in mathematics. Using the division-wide tool validated by experts in terms of content, it was designed to measure learners' numeracy skills, which are fundamental to their overall mathematical understanding. The pretest provided baseline data by focusing on core numeracy competencies, indicating specific areas where learners encountered difficulties. This assessment informed the application of conceptual understanding interventions in mathematics.

The pretest results established the learners' baseline performance, which would later be used as a reference point for comparison with the post-test outcomes. This comparison would enable an evaluation of the effectiveness of the conceptual understanding interventions, allowing for a data-driven analysis of the instructional strategies implemented in addressing the needs of struggling learners in mathematics.

On the other hand, the posttest was designed to evaluate the effectiveness of the conceptual understanding interventions applied over three weeks to improve the numeracy skills of the identified 30 struggling Grade 7 learners from Sampaloc National High School. These interventions were employed to address the specific gaps identified during the pretest, focusing on enhancing the numeracy skills of the learners, thereby improving their mathematical performance. The three-week intervention activities included educational videos, worksheets, and one-on-one tutoring, directly targeting the areas where learners had previously struggled.

Throughout the intervention period, learners were actively engaged in various intervention strategies that emphasized problem-solving, conceptual understanding, and the application of mathematical principles. Collaborative learning tasks, guided practice sessions, and real-life application problems were employed to deepen their comprehension and engagement with the material. The researcher also provided continuous feedback, allowing learners to reflect on their progress and gradually build their confidence in mathematics. The aim of the intervention was not only to improve academic performance but also to enhance learners' attitudes toward mathematics.

At the end of the three-week intervention, a posttest was administered under the same conditions as the pretest to measure the impact of the intervention strategies on the learners' performance. The posttest results provided data for comparing the pre-and post-intervention performance, helping to determine whether the intervention strategies led to measurable improvements in their numeracy skills.

### **Treatment of Data**

After the data had been collected using the questionnaire checklist, the researcher sorted, tallied, organized, and tabulated the data into an Excel Spreadsheet. This ensured the data was structured correctly and any errors or inconsistencies could be identified and corrected. The data collected was subjected to treatment using appropriate statistical tools.

To address the first problem, the analysis of Grade 7 learners' performance before and after the intervention strategy involved a detailed examination of their scores. Descriptive statistics were utilized to understand the learners' achievement levels. Calculating the mean, median, mode, range, and standard deviation of the pretest scores provided an overview of their initial and post-performance distribution. These analyses enabled a comparison of the learners' performance before and after the intervention, showing the effectiveness of conceptual understanding interventions for struggling learners in mathematics.

Furthermore, to address the second problem, inferential statistics was employed to determine the significance of any observed differences in the learners' performance. A paired-sample t-test was utilized to compare the mean pretest and posttest scores, providing a statistical measure of the effectiveness of the intervention strategy. A p-value less than 0.05 indicates a significant difference between the two sets of scores, suggesting that the intervention strategy has had a meaningful impact on the learners' conceptual understanding.

Finally, to address problem number 3, an action plan was proposed to enhance the performance of the struggling learners in mathematics. This plan includes targeted interventions, strategies suited to their specific needs, and measures to monitor progress and ensure continuous improvement in their mathematical skills.

### Ethical Considerations

This study was conducted with strict adherence to ethical research standards. Prior to data collection, informed consent was obtained from all participants, who were thoroughly informed about the purpose, procedures, and voluntary nature of their participation. Participants were assured that they could withdraw from the study at any point without any negative consequences.

Confidentiality and anonymity were maintained throughout the research process. All data collected were treated with the highest level of confidentiality, and personal identifiers were removed to ensure participant anonymity.

### III. Results and Discussion

#### Performance of Grade 7 Learners before and after the Implementation of Conceptual Understanding Interventions

Table 1 presents the performance of Grade 7 learners of Sampaloc National High School before and after the implementation of conceptual understanding interventions.

**Table 1: Performance of Grade 7 learners of Sampaloc National High School before and after the implementation of conceptual understanding interventions**

	Highest Possible Score	Highest Score	Lowest Score	Range	Overall Scores	Mean	Median	Mode	Standard Deviation
Pretest	50	21	0	21	337	11.23	11.50	18.00	5.32
Post Test	50	30	10	20	692	23.07	26.00	26.00	5.96

Based on the pretest results, the table shows that the highest possible score was 50, but the highest score obtained was only 21, reflecting that the learners answered 42% of the questions correctly. On the other hand, the lowest score recorded was 0, indicating that one learner was unable to answer any questions correctly. This difference results in a range of 21, highlighting the disparity in performance levels among the learners.

However, the results indicate that despite the notable increase in learner performance following the 3-week intervention session, there remains a significant need for further enhancement.

#### Significant Difference between the Performance of the Learners Before and After the Implementation of the Conceptual Understanding Intervention for Learners Struggling in Mathematics

Table 2 reflects whether there is a significant difference between the learners' performance before and after implementing the conceptual understanding intervention for learners struggling in mathematics.

**Table 2: Significant difference between the performance of the learners before and after the implementation of the conceptual understanding intervention for learners struggling in mathematics**

	Paired Samples Test						t	Df	Sig. (2-tailed)
	Mean	Paired Differences		95% Confidence Interval					
		Std. Deviation	Std. Error Mean	of the Difference					
				Lower	Upper				
Pretest- Posttest	-11.83333	3.59198	.65580	-13.17460	-10.49207	-18.044	29	.000	

It can be observed from the table that the mean difference between the pretest and post-test scores is -11.83, indicating that, on the average, learners improved by approximately 11.83 points after the intervention. At the same time, the standard deviation of 3.59 reflects the variability in the differences between the two sets of scores. The 95% confidence interval of the difference, ranging from -13.17 to -10.49, confirms that the actual mean difference is likely to fall within this range. Despite some learners still obtaining relatively low scores, the results reveal a significant overall improvement in performance.

Thus, the research hypothesis that there is a significant difference in the performance of the Grade 7 learners before and after the application of conceptual understanding intervention is accepted.

### **Proposed Plan of Action to Improve the Performance of the Learners Struggling in Mathematics**

The proposed plan of action is anchored on using PROJECT COUNT (Creating Opportunities for Understanding Numbers and Thinking). This proposal addresses the persistent gaps in numeracy skills among struggling learners, specifically in the context of four fundamental operations, particularly those identified through previous assessments as needing additional support in mathematics. This strategy will include differentiated instruction to meet the diverse needs of struggling learners and remediation sessions for those who continue to struggle in mathematics. Additionally, the plan includes continuous formative assessment to monitor progress and provide immediate feedback, allowing for timely instructional adjustments. A variety of instructional techniques will also be employed, focusing on individual learning profiles; the plan seeks to ensure that learners receive support to strengthen their conceptual understanding of basic numeracy skills.

In addition, parental involvement will be encouraged to reinforce learning at home, providing an approach that aligns classroom efforts with the learners' home environment. Communication between teachers and parents will be strengthened to ensure that learners receive consistent school and home support. Regular feedback mechanisms will be established to assess the effectiveness of these interventions, allowing for continuous refinement of strategies as needed.

The proposed plan of action was presented on the succeeding pages of this manuscript.

## PROJECT COUNT

### (Creating Opportunities for Understanding Numbers and Thinking)

#### 1. Overview

PROJECT COUNT (Creating Opportunities for Understanding Numbers and Thinking) was designed to further improve the numeracy performance of struggling learners through a comprehensive, structured approach. This project builds on the success of the previous conceptual understanding intervention while addressing the remaining learning gaps in foundational mathematics. The plan will employ differentiated instruction, continuous assessment, remediation, and collaborative learning, along with targeted support for both learners and teachers. The goal is to enhance numeracy skills, boost learner confidence in mathematics, and promote long-term academic success.

#### 2. Objectives

- a. To improve the numeracy skills of Grade 7 struggling learners by addressing individual learning needs.
- b. To implement a structured remediation program that includes differentiated instruction and personalized learning plans.
- c. To foster collaborative learning and engagement among learners through peer support and group activities.
- d. To establish regular formative assessments and feedback mechanisms to track learner progress and refine instructional strategies.
- e. To involve parents in reinforcing learning at home.

#### 3. Action Plan

Key Areas	Activities	Timeline	Persons Involved	Resources Needed	Success Indicators
Identification of Learner's Needs	- Assess learners' current numeracy skills using diagnostic tests. - Analyze pretest and post-test results to identify individual learning gaps.	January, 2025	Math Teachers, Learners	Diagnostic test materials, assessment tools	List of learners with identified learning gaps and areas for improvement.

Differentiated Instruction & Remediation	<ul style="list-style-type: none"> <li>- Develop individualized learning plans based on learner assessments.</li> <li>- Provide remediation sessions (small group or one-on-one).</li> <li>- Utilize varied teaching strategies (manipulatives, visual aids, real-world math applications) to address learning challenges.</li> </ul>	February, 2025	Math teachers, learners	Lesson plans, manipulatives, visual aids	Improved performance in formative assessments and classroom participation.
Peer Support & Collaborative Learning	<ul style="list-style-type: none"> <li>- Implement peer tutoring sessions, where more proficient learners assist struggling learners.</li> <li>- Conduct group problem-solving activities and collaborative projects related to numeracy skills.</li> </ul>	March, 2025	Math teachers, Peer tutors, learners	Activity materials, workshop guidelines	Increased engagement and collaboration, improved peer interactions.
Continuous Monitoring & Assessment	<ul style="list-style-type: none"> <li>- Establish formative assessments to measure learner progress.</li> <li>- Provide immediate feedback and adjust learning plans accordingly.</li> </ul>	March, 2025	Math teachers, learners	Feedback forms, Test papers	Regular updates on learner progress, improved test scores, and greater learner self-awareness of learning progress.
Family Involvement	<ul style="list-style-type: none"> <li>- Facilitate parent-teacher meetings to discuss learner progress and the role of home support.</li> <li>- Provide parents with resources and strategies to reinforce numeracy skills at home.</li> </ul>	March, 2025	Teachers, Parents, Parent Coordinator	Parental engagement materials	Increased parental involvement in reinforcing learner learning at home.
Evaluation and Reporting	<ul style="list-style-type: none"> <li>- Compile data from formative assessments, post-</li> </ul>	July, 2025	Teachers, School Administration, stakeholders	Evaluation templates, report materials	Final report showing significant

	tests, and teacher reports. - Evaluate the effectiveness of interventions and adjust strategies as needed. - Prepare and present a final report on PROJECT NUMERO's outcomes.				improvement in numeracy performance, reduction of learning gaps.
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#### 4. Success Indicators

- At least 80% of the struggling learners show improvement in their post-assessments.
- Narrowing of the performance gap between the lowest and highest scorers.
- Increased learner confidence and participation in math-related activities.
- Higher levels of engagement and collaboration during peer and group tasks.
- Teachers exhibit enhanced skills in diagnosing and addressing numeracy challenges.
- Active parental involvement in learner learning support.

### IV. Conclusion

In light of the findings of this research, several conclusions were drawn. The conceptual understanding intervention proved to be effective in enhancing the numeracy skills of Grade 7 learners, as evidenced by the improvement in their posttest results. However, despite the overall progress, some learners continued to struggle, suggesting that the intervention was not uniformly effective for all students. The significant difference observed between the pretest and posttest scores further confirms that the intervention had a positive impact on learners' performance. Nevertheless, the continued difficulties faced by some students highlight the need for ongoing support and the refinement of instructional strategies. Additionally, the proposed action plan, titled *Project COUNT*, has the potential to further improve the numeracy skills of the learners who continue to face challenges.

## V. Recommendations

Given the findings and conclusions of this research, several recommendations have been formulated. For school administrators and school leaders, it is recommended to implement the action plan titled *Project COUNT*, which aims to enhance learners' numeracy skills through targeted interventions and support. This is especially important considering that, while many learners showed significant improvement, some continue to struggle. For teachers, it is essential to conduct continuous formative assessments to regularly monitor learners' progress and identify specific areas needing additional support. Such ongoing evaluations will enable timely adjustments to instructional strategies, ensuring that no learner is left behind. Additionally, teachers are encouraged to integrate technology-based tools and resources into their instruction, as these can offer interactive and engaging learning experiences, particularly benefiting students who find mathematical concepts challenging. Lastly, for future researchers, further studies are recommended to explore alternative conceptual understanding strategies that may better support struggling learners and contribute to the development of more effective instructional approaches.

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