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Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Reciprocal Peer Teaching in Improving the Problem-Solving Skills Among Grade 5 Pupils

Allan A. Buiser
Calauan Central Elementary School, Calauan, Laguna, Philippines
Corresponding Author email: *allan.buiser@deped.gov.ph*

Received: 25 June 2024 **Revised**: 09 September 2024 **Accepted**: 17 September 2024

Available Online: 17 September 2024

Volume III (2024), Issue 3, P-ISSN – 2984-7567; E-ISSN - 2945-3577

Abstract
Aim: This experimental study investigated the effectiveness of the Reciprocal Peer Teaching (RPT) as an intervention material in improving the mathematical skills of grade five learners in Mathematics in terms of conceptual understanding, strategies and reasoning,computation and execution, and communication.
Methodology: In this study, a group of 30 pupils was exposed to Reciprocal teaching style through an experimental approach. This study's methodology entailed the modification of a particular variable or the application of a variety of teaching techniques in order to spot major variations in the way that students' skills improve.
Results: The RPT modified the students' understanding of mathematical word problems. The collaborative learning approach among the group was seen, as was the interactive technique. The enthusiasm for working together to find the correct solutions to the problem was also displayed. In fact, the RPT stimulates the students' participation in class; it changed from the attitude of being hesitant to the attitude that "I can do well by myself and by my team".
Conclusion: The RPT leads the students' collaboration in the classroom and has a positive effect on students' performance in active learning processes where different ideas can lead to more dynamic learning, increasing performance through active learning.

Keywords: *Communication, Computation, Conceptual understanding, Mathematical Insight, Problem Solving Skills, Reciprocal Peer Teaching*

INTRODUCTION

Republic Act No. 10533, also known as the "Enhanced Basic Education Act of 2013," is the foundation of the study, as stated in section 5: Curriculum Development:

> *The enhanced basic education curriculum will be developed by the Department of Education while following certain guidelines and criteria. These include constructivist, inquiry-based, reflective, collaborative, and integrative pedagogical approaches, as well as the following principles: (a) The curriculum shall be relevant, responsive, and research-based; (b) the curriculum shall be contextualized and global; and (c) the curriculum shall use these pedagogical approaches.*

The goal of education is to create individuals who are capable of competing, of being people who put the knowledge, abilities, and ideals they have acquired in school into practice (Abenojar, 2024; Amihan & Sanchez, 2023). It is possible to modify teaching techniques and procedures to better suit the needs of the students while also assisting them in identifying their interests, skills, and learning preferences.

It is common knowledge that students in a classroom exhibit unique differences (Sanchez & Sarmiento, 2020). The cognitive and affective development, social maturity, ability, motivation, aspirations, learning styles, demands, interests, and potential of every student are all unique (Sanchez, et al., 2022). Math aptitude is not an exception. In both the school curriculum and the study of other topics, mathematics is a necessary subject (Rizki & Priatna, 2019). The majority of students are said to dislike mathematics on the whole for a variety of reasons,

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including education, subject matter, students' cognitive, emotional, and psychomotor attitudes, and the learning environment. (Gafoor & Kurukkan, 2015).

The Philippine Government has been working hard to raise the standard of education in the country in order to address this issue. This is in response to the desire that graduates from the Philippines compete favorably with those who completed their education in other nations. A paradigm shift in education has been suggested, given legal approval, and put into practice. The Basic Education Curriculum, which was teacher-centered, was replaced by the statute, currently known as the Enhanced Basic Education Act of 2013. The decongestion of the educational material through the addition of two extra years to the Basic Education curriculum, currently known as the Senior High School, is one of its key aspects. Section 5 makes it clear that the Department of Education must follow rules and guidelines when creating the improved basic education curriculum.

The outdated, part-to-whole approach to education, with a focus on fundamental abilities, must be abandoned by teachers. The constructivist classroom presents the curriculum whole to part with a focus on broad concepts. These finest teaching techniques have an impact on and improve how pupils act, think, demonstrate, and exhibit knowledge. Simple or challenging academic tasks are used to increase student engagement in the constructivist classroom, and professors often engage students in conversation to foster a learning atmosphere (Shah, 2019). Constructivist instruction emphasizes practical applications that can be utilized to refocus the educational reform process. This method of instruction proposes new standards, a new teaching culture, and new organizational structures for classroom activities in the twenty-first century.

These are essential to the Department of Education's mission to create Filipinos with the values and skills necessary for them to reach their greatest potential. (Deped Vision, 2013).

Different tactics and strategies are altered, modified, and manipulated by teachers. They offer enjoyable activities to give students the finest experiences possible, ensuring the best instruction and exposure, which translates to higher performance in assessments used to gauge the quality of education. The numeracy abilities of grade nine students, which include mathematical problem-solving abilities, are the main emphasis of this study.

Students have many opportunities to build and master knowledge by establishing self-created concepts from concrete manipulations to pictorial representation, and this understanding is best exemplified in the students' ability to translate pictorial representation to abstract symbols because the process allows the students to make and understand the conception (Putri, 2015).

Objectives

This study attempted to examine the effects of Reciprocal Peer Teaching Strategies in developing the problem-solving skills among grade five pupils.

Specifically, it is geared towards answering the following questions:

1.) What is the level of problem-solving skills in Mathematics of the respondents before and after the use of the Reciprocal Peer Teaching Strategies on Problem Solving assessment in terms of :

- 1.1) conceptual understanding;
- 1.2) strategies and reasoning;
- 1.3) computation and execution, and
- 1.4) communication

2.) Is there a significant difference in the respondents' pre- and post-test scores as to their problem-solving abilities in mathematics?

Hypothesis

Within the group, there is a significant difference in the respondents' pre- and post-test scores as to their problem-solving skills in mathematics.

METHODS

Research Design

In this study, a group of 30 pupils was exposed to Reciprocal teaching style through an experimental approach. This study's methodology entailed the modification of a particular variable or the application of a variety of teaching techniques in order to spot major variations in the way that students' skills improve.

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Population and Sampling

Students from one section of 30 pupils from the fifth grade at Calauan Central Elementary School participated in this study as respondents. Cluster sampling was utilized to select the respondents because the researcher only has one math class with 30 pupils accessible. A non-probability sampling method called cluster sampling selects its participants based on their availability. Cluster sampling is the most popular kind of sampling technique (Oribhabor & Anyanwu, 2019), since it creates low and high sets of groups that can be compared while keeping all other factors constant.

Instrument

To ensure the validity of the questionnaire, it was edited, and then, finalized. There were pre-test and a post-test for the instrument. Each test included 5 questions, and each was with guided questions about conceptual understanding, approaches and reasoning, computation and execution, and communication of how to solve the problem.The instruments used to measure respondents' mathematical problem-solving abilities were created by teachers and were called the Problem-Solving Skills in Mathematics Test.

Data Gathering

Data were gathered in adherence to protocols in research and data collection, ensuring that the participants are convenient and their classes were uninterrupted.

Treatment of Data

Inferential statistics was used to interpret the collected raw data in order to give the data set a meaningful meaning. The mean and standard deviation was used to determine how the Reciprocal Peer Teaching Style were applied. The class overall performance was reflected in the mean, and the standard deviation revealed how far apart the response scores were. To describe the respondents' problem-solving skills, frequency andpercentage were used; and to determine the significant difference between the pretest and the posttest scores, paired t-test was utilized.

Ethical Considerations

The study ensured that all protocols in the ethical conduct of research have been complied.

RESULTS and DISCUSSION

The results are tabulated and accompanied by corresponding interpretations in this chapter.

Table 1. Pre-Test and Post Test in Problem Solving Skills of the Respondents Exposed to Reciprocal Peer Teaching Strategies in terms of Conceptual Understanding.

	PRE- TEST			POST- TEST		
Legend	Frequency	Percent	Verbal Interpretation	Frequency	Percent	Verbal Interpretation
4.6-5.0		0	Exemplary	23	76.67	Exemplary
3.6-4.5		0	Proficiency	6	20.00	Proficiency
2.6-3.5		0	Developing	1	3.33	Developing
1.6-2.5		0	Emerging		0.00	Emerging
0-1.5	30	100	Low Numerate		0.00	Low Numerate
TOTAL	30	100		30	100.00	

Table 1 presents the conceptual understanding pre- and post-test results of the respondents who were exposed to reciprocal peer teaching strategies in terms of problem-solving skills. When students used relevant data, appropriate representations, proper mathematical terminology, and appropriate mathematical techniques to solve

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mathematical problems, they were demonstrating it. Before exposure to the reciprocal peer teaching strategies, none of the students were classified as exemplary, proficient, developing, or emerging in problem-solving skills. However, a significant portion, 30 students, were categorized as having low numeracy levels where the respondents got 0-1.5 as their scores, indicating a baseline deficiency in this area.

After implementing reciprocal peer teaching strategies, there's a remarkable improvement. Now, 23 students are classified as exemplary wherein the respondents got a score 4.6 to 5 perfect score, showcasing a strong grasp of problem-solving concepts. Additionally, 6 students have reached a 3.6-4.5 score, indicating a solid understanding. Only one student remained in the developing level 2.6-3.5 score, suggesting that the vast majority have progressed significantly. Notably, there were no students categorized as emerging or with low numeracy levels anymore.

This data suggests that reciprocal peer teaching strategies have had a positive impact on the conceptual understanding of problem-solving skills among the respondents. It indicates that collaborative learning approaches like reciprocal peer teaching can effectively enhance students' comprehension and proficiency in challenging subjects.

Table 2. Pre-Test and Post Test in Problem Solving Skills of the Respondents Exposed to Reciprocal Peer Teaching Strategies in terms of Strategies and Reasoning.

			PRE- TEST			POST- TEST
Legend	Frequency	Percent	Verbal Interpretation	Frequency	Percent	Verbal Interpretation
4.6-5.0		0	Exemplary	18	60.00	Exemplary
3.6-4.5		0	Proficiency	11	36.67	Proficiency
2.6-3.5		0	Developing	1	3.33	Developing
1.6-2.5	13	26	Emerging		0.00	Emerging
0-1.5	17	56.67	Low Numerate		0.00	Low Numerate
TOTAL	30	100		30	100.00	

Table 2 displays the Pre- and Post-test results for the Respondents' Problem- Solving Skills after being exposed to reciprocal peer teaching strategies in terms of reasoning and strategies. It is a crucial skill that makes use of all other mathematical skills in a student. As their mathematical thinking develops, students realize that mathematics is comprehensible and makes sense. They acquire information on how to evaluate circumstances, select problem-solving tactics, make logical decisions, develop and explain solutions, and recognize when and how to put those solutions into practice.

In terms of strategies and reasoning, none of the students were categorized as exemplary, proficient, or developing prior to the application of reciprocal peer teaching strategies. Thirteen students, or a sizable portion, were classified as emerging, meaning that while they were not yet fully developed, they were beginning to show signs of proficiency. Furthermore, 17 students were identified as having low numerate levels, indicating a basic weakness in their capacity for problem-solving.

Significant gains in reasoning and strategy-related problem-solving abilities were observed after exposure to reciprocal peer teaching techniques. As a result of their advanced use of reasoning and diverse problem-solving techniques, eighteen students are now categorized as exemplary. Moreover, eleven students have attained proficiency, demonstrating a strong comprehension and utilization of these tactics. The great majority of students have advanced considerably, with only one student still in the developing level. Most notably, no longer are any students classified as emerging or having low numerical proficiency.

According to the data, the respondents' ability to reason and develop their problem-solving techniques were benefited from reciprocal peer teaching methods. The statement suggests that collaborative learning methodologies, such as reciprocal peer teaching, can effectively augment students' capacity to utilize a variety of strategies and reasoning techniques when addressing intricate problems.

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Table 3. Pre-Test and Post Test in Problem Solving Skills of the Respondents Exposed to Reciprocal Peer Teaching Strategies in terms of Computation and Execution.

	PRE- TEST			POST- TEST		
Legend	Frequency	Percent	Verbal Interpretation	Frequency	Percent	Verbal Interpretation
4.6-5.0		0	Exemplary		0.00	Exemplary
3.6-4.5		0	Proficiency	10	33.33	Proficiency
2.6-3.5		0	Developing	20	66.67	Developing
1.6-2.5	9	18	Emerging		0.00	Emerging
0-1.5	21	70.00	Low Numerate		0.00	Low Numerate
TOTAL	30	100		30	100.00	

Table 3 displays the pre- and post-test results for the respondents' problem-solving abilities after they were exposed to reciprocal peer teaching strategies in terms of computation and execution. Accurately completing each step, applying and labeling any visual aids related to the problem, and demonstrating how to use any available tools or technology are all required.

Regarding computation and execution skills, none of the students were categorized as exemplary, proficient, or developing prior to the implementation of reciprocal peer teaching strategies. Nine students, or a sizable portion, were classified as emerging, indicating that while they were not fully developed, they were starting to show signs of proficiency. Furthermore, a sizable portion of the student body—21—was identified as having low numerate levels, which suggests a basic weakness in their capacity to carry out computational tasks efficiently.

Following exposure to reciprocal peer teaching strategies, there was a notable improvement in problem-solving skills related to computation and execution. Although no students reached exemplary status, 10 students reached proficiency, indicating a solid understanding and execution of computational tasks. Furthermore, 20 students are classified as developing, suggesting significant progress in their computational abilities. Notably, there are no students categorized as emerging or with low numeracy levels anymore.

According to the data, the respondents' ability to solve problems involving computation and execution improved as a result of reciprocal peer teaching approaches. It suggests that methods for collaborative learning, such as reciprocal peer teaching, can significantly improve students' capacity to complete computational tasks accurately and quickly.

Table 4. Pre-Test and Post Test in Problem Solving Skills of the Respondents Exposed to Reciprocal Peer Teaching Strategies in terms of Communication.

	PRE- TEST			POST- TEST		
Legend	Frequency	Percent	Verbal Interpretation	Frequency	Percent	Verbal Interpretation
4.6-5.0		0	Exemplary		0.00	Exemplary
3.6-4.5	4	8	Proficiency	10	33.33	Proficiency
2.6-3.5	16	32	Developing	20	66.67	Developing
1.6-2.5		0	Emerging		0.00	Emerging
0-1.5		0.00	Low Numerate		0.00	Low Numerate
TOTAL	20	100		30	100.00	

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Table 4 shows Pre-Test and Post Test in Problem Solving Skills of the Respondents Exposed to Reciprocal Peer Teaching Strategies in terms of Communication. It involves accurately carrying out all steps, applying and labeling any visual representations of the issue, and demonstrating the proper application of any accessible manipulatives or technology.

Regarding communication skills, none of the students were categorized as exemplary, emerging, or falling into the low numerate level category prior to the application of reciprocal peer teaching strategies. Only four students, though, met the proficiency level, demonstrating a strong command of communication in contexts involving problem-solving. Furthermore, sixteen students were labeled as developing, which suggests that although they were improving their communication abilities, they were still not at the proficiency level.

Regarding communication skills, none of the students were categorized as exemplary, emerging, or falling into the low numerate level category prior to the application of reciprocal peer teaching strategies. Only four students, though, met the proficiency level, demonstrating a strong command of communication in contexts involving problem-solving. Furthermore, sixteen students were labeled as developing, which suggests that although they were improving their communication abilities, they were still not at the proficiency level.

The available data indicates that the implementation of reciprocal peer teaching strategies has had a positive effect on the respondents' ability to solve problems related to communication. It suggests how students' ability to effectively communicate their problem-solving processes and solutions can be improved through collaborative learning strategies like reciprocal peer teaching.

Table 5. Summary of the difference between the respondents' pre- and post-test scores for their problem-solving skills in Mathematics.

PROBLEM SOLVING SKILLS	PRE-test		POST-test		t	df	Sig.(2-tailed)	Verbal Interpretation
	Mean	SD	Mean	SD				
Conceptua	1.00	0.00	4.66	0.38	-53.367	29	.000	**Significant**
Strategies	1.34	0.39	4.51	0.37	-32.809	29	.000	**Significant**
Computati	2.71	0.34	4.35	0.44	-17.287	29	.000	**Significant**
Communic	2.52	0.90	3.06	0.24	-2.959	29	.006	**Significant**

Legend: If p-value Sig. (2-tailed) ≤.05, then it is statistically significant. If p-value Sig.(2-tailed) >.05, then it is NOT statistically significant.

As shown in the table, there are significant differences among the posttest scores performances of the groups of respondents subjected to Reciprocal Peer Teaching strategies on problem-solving skills assessment as to conceptual understanding, Strategies and Reasoning, Computation and execution, and Communication. This implies that, after using the RPT, there is an improvement on the problem-solving skills of the students Since the RPT has proven effective in enhancing the problem-solving skills of the students, it simply means that the use of the particular strategies similarly improved the capacities of the students on conceptual understanding, computation and execution, strategies, reasoning, and communication.

As to conceptual understanding, the respondents used correct mathematical terminologies and were able to use proper mathematical techniques for mathematical issues. Strategies and reasoning: the respondents developed, the ability to be aware and gain knowledge about how to assess and choose strategies to use, create, and describe solutions, and understand when and how to apply the correct solutions to the problem. Computation and Execution: the accuracy of the respondents in applying the steps and labeling visual representations of the problem was demonstrated. The rules regarding how to solve problems were demonstrated, and in terms of communication, the respondents were able to express themselves freely, explain, and describe their ideas on how to solve the problem given.

As the RPT was engaged, the group students worked together to discuss the assigned problem, wherein the roles of each member as predictor, questioner, clarifier, and summarizer gave them the chance to exchange thoughts about how to solve the problem. The RPT modified the students' understanding of mathematical word problems. The

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collaborative learning approach among the group was seen, as was the interactive technique. The enthusiasm for working together to find the correct solutions to the problem was also displayed. In fact, the RPT stimulates the students' participation in class; it changed from the attitude of being hesitant to the attitude that I can do well by myself and by my team. The RPT leads the students' collaboration in the classroom and has a positive effect on students' performance in active learning processes where different ideas can lead to more dynamic learning, increasing performance through active learning.

Conclusions

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

1. There is a significant difference between the pretest and posttest of the respondents as to skills performance in mathematics, thus, the stated hypothesis that there is no significant difference in the pretest and posttest of the respondents is not supported.
2. The stated hypothesis that there is no significant difference in the skills performance is not supported because there is a significant difference in the respondents' group's skills performance.
3. Reciprocal peer teaching strategies and math problem-solving skills performance do not significantly correlate. This demonstrated that students' performance demonstrated an improvement in their ability to solve mathematical problems, irrespective of the use of reciprocal peer teaching strategies. Therefore, it is accepted that there is no meaningful correlation between Grade 5 students' performance in mathematics problem-solving skills and their use of reciprocal peer teaching strategies.

Recommendations:

The following recommendations are hereby formulated:

1. Findings revealed that students from RPT show a high level of Dependent Variable. Therefore, it is suggested for teachers to incorporate RPT programs to enhance the pupils' proficiency in handling mathematical problems.
2. It is suggested to use RPT based learning approaches across different subject areas. According to this study, it significantly affects students, which is a better approach for them to improve their problem-solving abilities.
3. For the students, it is more advisable to engage in Reciprocal peer teaching. Any mathematical tests they take will be easier for them because RPT recommends that students solve problems while collaborating in groups to improve their problem-solving abilities and solve any math problems.
4. The study may assist future researchers in performing fresh research on Reciprocal Peer Teaching strategies and problem-solving techniques, and it may be used as a reference. Their future research will benefit from this study's development.

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