

RECIPROCAL APPROACH ON THE STUDENTS' MATHEMATICAL SKILLS

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ABSTRACT

The purpose of this study is to determine the effect reciprocal approach on grade 7 students' mathematical skills at Pedro Guevara Memorial National High School, Santa Cruz, Laguna S.Y. 2022 – 2023.

Specifically, it sought to answer the following questions: (1) What is the level of reciprocal approach in terms of predicting, clarifying, solving, and summarizing? (2) What is the level of students' mathematical skills before and after using reciprocal approach in terms of critical thinking, arithmetic, and problem solving? (3) Is there a significant difference on the student's mathematical skills before and after using reciprocal approach? (4) Does reciprocal approach have a significant effect on the student's mathematical skills after using reciprocal approach?

The respondents consisting of 121 Grade 7 students which were purposively selected. The instrument used in this study was a validated self-made questionnaire consisting of 5 questions per variable. A parallel pre-test and post-test were also administered to find out if the reciprocal approach enhances students' mathematical skills as determined by their average score.

Results of the study showed that the level of students' assessment with regards to reciprocal approach was very high. Likewise, students' mathematical skills in all areas under consideration got a fair remark before using reciprocal approach while a very satisfactory remark was obtained after using it. The former serves as the baseline data to find out if there was an improvement in the mathematical skills of the respondents as revealed by their overall scores.

Further, the difference in pre-test and post-test was found significant at 5% level. With the results obtained, the following is hereby recommended for consideration: (1) DepEd officials, Administrators of public schools including the Principal and Head Teachers, are encouraged to provide materials and to conduct seminars that will develop their teachers' ability in different teaching strategies since it enhances the student's mathematical skills. (2) Teacher may administer pre-test to identify student's prior knowledge and to focus on the topics that need to be addressed also evaluate how much they have learned. (3) Teacher can apply new teaching approach like reciprocal to arouse the interest of the students. (4) Since it was found out that the use of reciprocal approach had a significant effect on the students' mathematical skills, the researcher suggested that the teacher may use reciprocal approach for the daily classroom instruction. (5) Since the study was only confined to three sections, it is suggested that the future researcher may conduct related study with bigger population to acquire more accurate results.

Keywords:

Reciprocal approach, Mathematical Skills

INTRODUCTION

During the covid – 19 pandemic, teachers have had to adapt their typical teaching techniques for classes that now sometimes take place online. Teachers are culling learning standards, ditching answer-getting tests, and turning to math games and apps to supplement instruction. They're also reaching out to parents for support and finding ways to engage students over screens, including with lessons about how math and social justice intersect. In this online summit, readers will get to ask their questions about how COVID-19 has affected achievement, instruction, assessment, and engagement in math.

Due to rapid changes of teaching, it has affected the students learning and even their reading comprehension. Applying reciprocal approach can help the students to improve their understanding and they will also learn mathematics with the help of their classmates. Reciprocal approach allows the students to become the teacher, while working in a small group setting. Start off with the teacher demonstrating the model using the four strategies: predicting, clarifying, solving, and summarizing to guide conversation working towards students taking turns being the teacher and facilitating the reciprocal teaching model. With reciprocal approach students will learn the benefit of meaningful discussion with their peers, strengthen their problem-solving skills, and to critically analyze their own work.

The reciprocal approach can be applied in various courses and is intended to enhance basic reading comprehension techniques. The reciprocal approach is very successful at assisting learners in solving mathematical word problems because it is adaptable and versatile for different levels of learners. Reciprocal approach for mathematics appears to be an essential strategy for nurturing a more in-depth understanding of the text of mathematical word problems at the elementary level. This instructional approach could enhance an extraordinary level of skill in critical thinking, reasoning, and understanding.

This study aims to determine the effect of reciprocal approach on the students' mathematical skills of Grade 7 students at Pedro Guevara Memorial National High School, Santa Cruz, Laguna School Year 2022 – 2023.

Specifically, it seeks to answer the following questions:

1. What is the level of reciprocal approach in terms of:
 - 1.1 predicting;
 - 1.2 clarifying;
 - 1.3 solving; and
 - 1.4 summarizing?
2. What is the level of students' mathematical skills before and after using reciprocal approach in terms of:
 - 2.1 critical thinking;
 - 2.2 arithmetic; and
 - 2.3 problem solving?
3. Is there a significant difference on the student's mathematical skills before and after using the reciprocal approach?
4. Does reciprocal approach have a significant effect on the student's mathematical skills after using the reciprocal approach?

REVIEW OF RELATED LITERATURE

Mathematics provides an effective way of building mental discipline and encourages logical reasoning and mental rigor. In addition, mathematical knowledge plays a crucial role in understanding the contents of other school subjects such as science, social studies, and even music and art. Mathematical skills are conceptualized as a separate area that includes verbal components (number knowledge, counting, computation, and reasoning) and nonverbal components (math notation, reasoning in time and space, and computation).

One of the mathematical skills is the critical thinking skill, it is a thinking that reveals the right thinking by having the ability to use various concepts with their meanings, to make inferences by making suggestions and to make reasoning by focusing on problem solving (Baserer, D. 2020).

Aside from critical thinking skill students also need to learn arithmetic skill, (Guhl, P. 2019) states that arithmetic skill is being able to count, compare, classify, and do geometry are necessary skills for elementary school math and beyond but are meaningless unless students can apply their learning outside of a rote math problem. Students also need to learn logical thinking, problem solving and reasoning skills alongside early math instruction.

Problem solving is a part of thinking, that are advantageous when resolving complicated and multidimensional challenges. Problem-solving skills can be developed through active learning models that engage students in the learning process (Manhanal, S. 2019).

Students can enhance their mathematical skills thru reciprocal approach is is an enhancement strategy that will be used in this study. Reciprocal approach is an instructional technique developed by Palincsar and Brown and described by them as “a dialogue between teachers and students for the purpose of jointly constructing the meaning of text.” It is designed to improve students’ reading comprehension by teaching four key reading strategies such as predicting what may come next, clarifying ambiguities, solving questions, and summarizing the main content. According to Satriani, et. al. (2022), the reciprocal approach can assist students grasp the material by expanding their background knowledge. It has the capacity to broaden students' previous understanding. It encourages students to participate in the reading activity by allowing them to collaborate with their peers, and it allows all students to participate in the learning process by practicing reading comprehension.

Reciprocal approach is composed of four strategies: predicting, clarifying, solving, and summarizing. Predicting is the first strategy on the reciprocal approach. Predicting supports the development of critical thinking skills by requiring students to draw upon their prior knowledge and experiences as well as observations to anticipate what might happen. During the prediction stage the learner is required to predict the type of mathematical questions they are being asked, what type of mathematical operations they may be required to use and what their answer might look like. As part of the clarification stage, learners are encouraged to work as part of a group. Group work provides an opportunity for students to talk and socially interact with their peers; it helps them to construct meaning and promotes learning and literacy. During the solving stage learners solve the problem. Learners are provided with several problem-solving options, though at no stage are the students directed to a specific problem-solving strategy. This empowers the student to develop a solution which is pertinent to them as learners. The summarizing stage is completed by the individual as a self-reflection. This stage requires learners to evaluate how they contributed to the group task. The learner is also required to reflect on the strategies they have selected and to evaluate how they would refine the process if presented with a similar problem. The learner is also asked to justify their answer. To further enhance the mathematical

understanding of all the students in the class, at the conclusion of each lesson we discuss and reflect on the mathematical solutions that have been offered by each group (Reilly, Y. et. al. 2013).

METHODOLOGY

Descriptive – Quantitative Research Design was employed in this study. This design according to Sirisilla, (2023), is a powerful tool used by scientists and researchers to gather information about a particular group or phenomenon. Quantitative method is aimed at discovering how many people think, act, or feel in a specific way.

From the population, one – hundred twenty (121) grade 7 students at Pedro Guevara Memorial National High School were selected purposively a non-probability sampling technique. This technique was due to homogeneity of the population in terms of grade level and the used of reciprocal approach in teaching.

The research instrument used in this study were self – made checklist that consists of 25 questions, it is intended to get the students' perception on the use of reciprocal approach and self - made questionnaire (pre-test and post-test) which is a multiple-choice type of test consists of 15 items per mathematical skills (critical thinking, arithmetic, and problem solving)

After all the data were gathered, classified, and tabulation followed according to variable and subjected to statistical treatment. Mean and standard deviation was used to describe the level of reciprocal approach in terms of predicting, clarifying, solving, and summarizing; mean and standard deviation to describe grade 7 students' mathematical skills relative to critical thinking, arithmetic, and problem solving; t-test to determine the significant difference on the student's mathematical skills before and after using reciprocal approach and to determine if reciprocal approach have a significant effect on the student's mathematical skills after using reciprocal approach.

RESULT AND DISCUSSION

Table 1. Level of Respondents' Perception on Reciprocal Approach

STATEMENTS	MEAN	SD	REMARKS
<i>I actively participate in our discussion.</i>	4.62	0.55	Strongly Agree
<i>I actively look for different clues and ideas throughout the reading selection.</i>	4.64	0.48	Strongly Agree
<i>I enthusiastically work with my classmates.</i>	4.62	0.49	Strongly Agree
<i>I enjoy learning with my classmates.</i>	4.64	0.48	Strongly Agree
<i>I easily share ideas to my classmates.</i>	4.68	0.48	Strongly Agree
Weighted Mean		4.64	
SD		0.496	
Verbal Interpretation		Very High	

Table 1 presents the level of students' perception on reciprocal approach which shows the mean, standard deviation, and verbal interpretation. Respondents *strongly agree* that reciprocal approach used by the teacher help them to easily share ideas (M=4.62, SD=0.48), to actively look for different clues and ideas throughout the reading selection (M=4.64, SD=0.48), and they enjoy learning with their classmates. Likewise, respondents also *strongly agree* that through reciprocal approach they were encouraged to actively participate in the discussion (M=4.62, SD=0.55). The weighted mean of 4.64 indicate that the level of respondents' perception in reciprocal approach is *Very High*.

Table 2. Level of Students' Perception on Reciprocal Approach in Terms of Predicting

STATEMENTS	MEAN	SD	REMARKS
<i>I identify the mathematical symbols used in the reading selection.</i>	4.56	0.50	Strongly Agree
<i>I identify the clue word to solve the problem.</i>	4.42	0.50	Strongly Agree
<i>I connect my previous learning to the new topic.</i>	4.62	0.49	Strongly Agree
<i>I use shapes and symbols to easily understand the problem.</i>	4.62	0.49	Strongly Agree
<i>I draw or create a diagram to clarify the problem.</i>	4.83	0.37	Strongly Agree
Weighted Mean		4.61	
SD		0.47	
Verbal Interpretation		Very High	

Table 2 revealed the students' level of perception on reciprocal approach in terms of predicting. The respondents *strongly agree* that reciprocal approach used by the teacher helps them to draw or create a diagram to clarify the problem ($M=4.83$, $SD=0.37$), use shapes and symbols to easily understand the problem, connect their previous learning to the new topic ($M=4.62$, $SD=0.49$). However, the item with the lowest rating was the reciprocal approach that helped them to identify the clue word to solve the problem ($M=4.42$, $SD=0.50$). All the item indicators for the respondents' perception on reciprocal approach in terms of predicting were verbally interpreted as *Very High*.

Table 3. Level of Students' Perception on Reciprocal Approach in Terms of Clarifying

STATEMENTS	MEAN	SD	REMARKS
<i>I ask about the unclear parts to my teacher.</i>	4.57	0.50	Strongly Agree
<i>I ask about the unclear parts to my classmates.</i>	4.51	0.50	Strongly Agree
<i>I ask the unfamiliar words to my teacher.</i>	4.56	0.50	Strongly Agree
<i>I ask the unfamiliar words to my classmates.</i>	4.69	0.47	Strongly Agree
<i>I ask about the step-by-step procedure in solving the problem.</i>	4.76	0.43	Strongly Agree
Weighted Mean		4.62	
SD		0.48	
Verbal Interpretation		Very High	

Table 3 revealed the students' level of perception on reciprocal approach in terms of clarifying. The respondents *strongly agree* that reciprocal approach used by the teacher allow them to ask about the step-by-step procedure in solving the problem ($M=4.76$, $SD=0.43$), and to ask unfamiliar words to their classmates ($M=4.69$, $SD=0.47$). However, the item with the lowest rating was the reciprocal approach allow them to ask about the unclear parts to their classmates ($M=4.51$, $SD=0.50$).

All the item indicators for the respondents' perception on reciprocal approach in terms of clarifying were verbally interpreted as *Very High*.

Table 4. Level of Students' Perception on Reciprocal Approach in Terms of Solving

STATEMENTS	MEAN	SD	REMARKS
<i>I solve problems without the help of my classmates.</i>	4.59	0.49	Strongly Agree
<i>I solve problems without the help of my</i>	4.51	0.50	Strongly Agree

teacher.

I solve the problem using the context clues. 4.57 0.50 Strongly Agree

I analyze the problem and use a step-by-step process in solving it. 4.66 0.48 Strongly Agree

I explain the procedures and methods in a word problem. 4.80 0.40 Strongly Agree

Weighted Mean

4.63

SD

0.474

Verbal Interpretation

Very High

Table 4 revealed the students' level of perception on reciprocal approach in terms of solving. The respondents *strongly agree* that reciprocal approach used by the teacher allow them to explain the procedures and methods in a word problem (M=4.80, SD=0.40), and analyze the problem and use a step-by-step process in solving it (M=4.66, SD=0.48). However, the item with the lowest rating was the reciprocal approach allow them to solve problems without the help of the teacher (M=4.51, SD=0.50).

All the item indicators for the respondents' perception on reciprocal approach in terms of solving were verbally interpreted as *Very High*.

Table 5. Level of Students' Perception on Reciprocal Approach in Terms of Summarizing

STATEMENTS	MEAN	SD	REMARKS
<i>I use key words and phrases to explain our lesson.</i>	4.56	0.49	Strongly Agree
<i>I identify the main idea on the given reading selection.</i>	4.45	0.50	Strongly Agree
<i>I focus on the key details.</i>	4.59	0.49	Strongly Agree
<i>I include the important information.</i>	4.67	0.47	Strongly Agree
<i>I state the learnings from the lesson with full comprehension.</i>	4.80	0.41	Strongly Agree
Weighted Mean		4.61	
SD		0.472	
Verbal Interpretation		<i>Very High</i>	

Table 5 revealed the students' level of perception on reciprocal approach in terms of summarizing. The respondents *strongly agree* that reciprocal approach used by the teacher allow them to state the learnings with full comprehension (M=4.80, SD=0.41), and include the important information (M=4.67, SD=0.47). However, the item with the lowest rating was the reciprocal approach allow them to identify the main idea on the given reading selection (M=4.45, SD=0.50).

All the item indicators for the respondents' perception on reciprocal approach in terms of solving were verbally interpreted as *Very High*.

Table 6. Level of Students' Mathematical Skills Before and After using Reciprocal Approach in Terms of Critical Thinking

SCORES	BEFORE		AFTER		DESCRIPTIVE EQUIVALENT
	Frequency	Percentage	Frequency	Percentage	
13 – 15	0	0%	12	10%	Outstanding
10 – 12	6	5%	109	90%	Very Satisfactory
7 – 9	37	31%	0	0%	Satisfactory
4 – 6	57	47%	0	0%	Fair
0 – 3	21	17%	0	0%	Needs Improvement
Total	121	100%	121	100%	
Weighted Mean		5.67		11.88	
Lowest Score		2		11	
Highest Score		10		14	
SD		2.328		0.635	

Legend:

Range	Interpretation
13 – 15	Outstanding
10 – 12	Very Satisfactory
7 – 9	Satisfactory
4 – 6	Fair
0 – 3	Needs Improvement

Table 6 shows the level of students' mathematical skills before using reciprocal approach in terms of critical thinking.

The table shows the level of students' mathematical skills before using reciprocal approach in terms of critical thinking, indicates that out of one hundred twenty – one (121) grade 7 students, the scores "4 to 6" got the highest frequency of 57 or 47% of the sample population and with descriptive equivalent of *Fair*, the scores "7 to 9" got the frequency of 37 or 31% of the sample population and with descriptive equivalent of *Satisfactory*, and the scores "0 to 3" got the lowest frequency of 21 or 17% of the sample population and with descriptive equivalent of *Needs Improvement*. With the weighted mean of 5.67, standard deviation of 2.328, lowest score of 2 and highest score of 10 shows that the level of students' mathematical skills before using reciprocal approach in terms of critical thinking is verbally interpreted as *Fair*.

While the level of students' mathematical skills after using reciprocal approach in terms of critical thinking, indicates that out of one hundred twenty – one (121) grade 7 students, the scores "10 to 12" got the highest frequency of 109 or 90% of the sample population and with descriptive equivalent of *Very Satisfactory*, and the scores "13 to 15" got the lowest frequency of 12 or 10% of the sample population and with descriptive equivalent of *Outstanding*. With the weighted mean of 11.88, standard deviation of 0.635, lowest score of 11 and highest score of 14 shows that the level of students' mathematical skills after using reciprocal approach in terms of critical thinking is verbally interpreted as *Very Satisfactory*.

Table 7. Level of Students' Mathematical Skills Before and After using Reciprocal Approach in Terms of Arithmetic

SCORES	BEFORE	AFTER	DESCRIPTIVE EQUIVALENT
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	<i>Frequency</i>	<i>Percentage</i>	<i>Frequency</i>	<i>Percentage</i>	
13 – 15	0	0%	13	11%	Outstanding
10 – 12	0	0%	103	85%	Very Satisfactory
7 – 9	27	22%	5	4%	Satisfactory
4 – 6	76	63%	0	0%	Fair
0 – 3	18	15%	0	0%	Needs Improvement
Total	121	100%	121	100%	
Weighted Mean	5.32		11.29		
Lowest Score	1		7		
Highest Score	8		14		
SD	1.629		1.281		

Legend:

Range	Interpretation
13 – 15	Outstanding
10 – 12	Very Satisfactory
7 – 9	Satisfactory
4 – 6	Fair
0 – 3	Needs Improvement

Table 7 shows the level of students' mathematical skills before and after using reciprocal approach in terms of arithmetic.

The table shows the level of students' mathematical skills before using reciprocal approach in terms of arithmetic, indicates that out of one hundred twenty – one (121) grade 7 students, the scores “4 to 6” got the highest frequency of 76 or 63% of the sample population and with descriptive equivalent of *Fair*, the scores “7 to 9” got the frequency of 27 or 22% of the sample population and with descriptive equivalent of *Satisfactory*, and the scores “0 to 3” got the lowest frequency of 18 or 15% of the sample population and with descriptive equivalent of *Needs Improvement*. With the weighted mean of 5.32, standard deviation of 1.629, lowest score of 1 and highest score of 8 shows that the level of students' mathematical skills before using reciprocal approach in terms of arithmetic is verbally interpreted as *Fair*.

While the level of students' mathematical skills after using reciprocal approach in terms of arithmetic, indicates that out of one hundred twenty – one (121) grade 7 students, the scores “10 to 12” got the highest frequency of 103 or 85% of the sample population and with descriptive equivalent of *Very Satisfactory*, the scores “13 to 15” got the frequency of 13 or 11% of the sample population and with descriptive equivalent of *Outstanding*, the scores “7 to 9” got the lowest frequency of 5 or 4% of the sample population and with descriptive equivalent of *Satisfactory*. With the weighted mean of 11.29, standard deviation of 1.281, lowest score of 7 and highest score of 14 shows that the level of students' mathematical skills after using reciprocal approach in terms of arithmetic is verbally interpreted as *Very Satisfactory*.

Table 8. Level of Students' Mathematical Skills Before and After using Reciprocal Approach in Terms of Problem Solving

SCORES	BEFORE		AFTER		DESCRIPTIVE EQUIVALENT
	Frequency	Percentage	Frequency	Percentage	
13 – 15	0	0%	19	16%	Outstanding
10 – 12	0	0%	76	63%	Very Satisfactory
7 – 9	0	0%	26	21%	Satisfactory
4 – 6	13	11%	0	0%	Fair
0 – 3	108	89%	0	0%	Needs Improvement
Total	121	100%	121	100%	
Weighted Mean		1.85		10.64	
Lowest Score		0		7	
Highest Score		4		14	
SD		1.358		1.697	

Legend:

Range	Interpretation
13 – 15	Outstanding
10 – 12	Very Satisfactory
7 – 9	Satisfactory
4 – 6	Fair
0 – 3	Needs Improvement

Table 9. Difference Between the Students' Mathematical Skills Before and After Using Reciprocal Approach

MATHEMATICAL SKILLS	MEAN		T-VALUE	CRITICAL T-VALUE		P-VALUE	ANALYSIS
	PRE-TEST	POST-TEST					
<i>Critical Thinking</i>	5.68	11.88	27.837	1.984	0.0000		Significant
<i>Arithmetic</i>	5.32	11.29	31.968	1.984	0.0000		Significant
<i>Problem Solving</i>	1.85	10.64	45.437	1.984	0.0000		Significant

Table 9 presents the difference between students' performance before and after using reciprocal approach. The data were statistically treated using the t-test. The pre-test is paired to the post-test scores of students using reciprocal approach to improve the mathematical skills of selected Grade 7 students.

The t-value of 27.837 in critical thinking skills is greater than the critical t-value of 1.984 and supported with p-value of 0.0000, it can infer that there is an increase in the performance and the analysis is Significant, The t-value of 31.968 in arithmetic skills is greater than the critical t-value of 1.984 and supported with p-value of 0.0000, it can infer that there is an increase in the performance and the analysis is Significant, and the t-value of 45.437 in problem solving skills is greater than the critical t-value of 1.984 and supported with p-value of 0.0000, it can infer that there is an increase in the performance and the analysis is Significant.

Based on the data, it is shown that there is a significant difference between students' mathematical skills before and after using reciprocal approach at 0.05 level of significance.

Table 10. Effect on the Students' Mathematical Skills After Using Reciprocal Approach

<i>MATHEMATICAL SKILLS</i>	<i>MEAN</i>	<i>T-VALUE</i>	<i>CRITICAL T-VALUE</i>	<i>P-VALUE</i>	<i>ANALYSIS</i>
<i>Critical Thinking</i>	11.88	27.837	1.984	0.0000	Significant
<i>Arithmetic</i>	11.29	31.968	1.984	0.0000	Significant
<i>Problem Solving</i>	10.64	45.437	1.984	0.0000	Significant

Table 10 presents the effect on the students' mathematical skills after using reciprocal approach. The data were statistically treated using the t-test.

Based on the data, it is shown that there is "significant effect on the students' mathematical skills after using reciprocal approach" at 0.05 level of significance. It shows that the null hypothesis stating that "*There is no significant effect on the students' mathematical skills after using reciprocal approach*" is rejected, it can infer that there is "significant" effect between them.

CONCLUSION

The level of the students' assessment on the use of reciprocal approach in terms of predicting, clarifying, solving, and summarizing are all Very High, the level of the students' mathematical skills before using reciprocal approach in terms of critical thinking, arithmetic, and problem solving is Fair and in the level of the students' mathematical skills after using reciprocal approach in terms of critical thinking, arithmetic, and problem solving is Very Satisfactory.

The t-computed value was greater than the t-critical value regardless of the sign. Therefore, it proves that there is a significant effect on the use of reciprocal approach on the students' mathematical skills. Since that reciprocal approach has a significant effect, it is effective to use as an alternative approach.

Recommendations

1. DepEd officials, Administrators of public schools including the Principal and Head Teachers, are encouraged to provide materials and to conduct seminars that will develop their teachers' ability in different teaching strategies since it enhances the student's mathematical skills.
2. Teacher may administer pre-test to identify student's prior knowledge and to focus on the topics that need to be addressed also evaluate how much they have learned.
3. Teacher can apply new teaching approach like reciprocal to arouse the interest of the students.
4. Since it was found out that the use of reciprocal approach had a significant effect on the students' mathematical skills, the researcher suggested that the teacher may use reciprocal approach for the daily classroom instruction.
5. Since the study was only confined to three sections, it is suggested that the future researcher may conduct related study with bigger population to acquire more accurate results.

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