

IMPACT OF RECIPROCAL TEACHING IN MATHEMATICS

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ABSTRACT :The study was conducted to determine level of performance using reciprocal teaching in Mathematics among Grade 9 students in Luis National High School of Zone 1, DepEd Division of Zambales. Reciprocal teaching was used in this research because it was believed to be useful technique for enhancing students' performance. This research study employed quasi (descriptive-experimental) research design. Descriptive and inferential statistics were used for data analysis, interpretations and discussions.

Findings show that the pre-test performance of the Grade 9 students in parallelogram in terms of 'proving that both pairs of opposite sides are parallel' was Approaching Proficiency. However, the pre-test performance on 'proving that both pairs of opposite sides are congruent'; 'proving that both pairs of opposite sides are both congruent and parallel'; 'proving that the diagonals of the quadrilateral bisect each other'; and 'proving the pairs of opposite angles are congruent' was Beginning.

The post-test performance of the students in terms of proving that both pairs of opposite sides are parallel and proving the pairs of opposite angles are congruent was Approaching Proficiency. While the post-test performance on 'proving that both pairs of opposite sides are congruent'; 'proving that both pairs of opposite sides are both congruent and parallel'; and 'proving that the diagonals of the quadrilateral bisect each other' was Developing or Fairly Satisfactory.

Moreover, a significant difference on the students' performances on pre – test and post – test in proving that both pairs of opposite sides are congruent; in proving that both pairs of opposite sides are parallel; in proving that both pairs of opposite sides are both congruent and parallel; in proving that the diagonals of the quadrilateral bisect each other; and in proving the pairs of opposite angles are congruent was established.

The researcher recommends that Mathematics teachers may take opportunities to further improve the skills in the utilization of reciprocal teaching in secondary Mathematics. Mathematics teachers in secondary schools in the Division of Zambales may utilize further the reciprocal teaching and other teaching pedagogies and learning activities aimed for the students to further learn parallelogram primarily proving that both pairs of opposite sides are congruent; proving that both pairs of opposite sides are both congruent and parallel; and proving that the diagonals of the quadrilateral bisect each other. The public secondary school in the Division of Zambales may introduce the use of reciprocal teaching to learners in the Junior and Senior High school levels. They may formulate policies that would encourage teachers to utilize reciprocal teaching approach for their classes to maximize teachers' potential in making more effective strategies. Lastly, the Mathematics teachers are encouraged to conduct an in – depth study on the effects of reciprocal teaching and other teaching pedagogies in Mathematics in other year levels (Junior and Senior High school) in secondary schools in the Division of Zambales.

KEYWORDS : *reciprocal teaching, parallelogram, pre-test, post-test, Mathematics*

I. INTRODUCTION

Numeracy in practice is teaching, learning and using mathematics; numeracy is best described as mathematical literacy; and a broad set of acquired behaviors and dispositions important for effective participation in society [Department of Education and Early Childhood Development (DEECD), 2009].

Teachers in Mathematics should be concerned if their students are under-performing or facing with written mathematical problems. Although, it was recognized that the building of academic vocabulary as described by [1] is critical for developing mathematical literacy, it was also observed that there were difficulties the students encountered with understanding the mathematical meaning of simple words. This is a problem identified in the NSW Department of Education and Training, stating that 'comprehension of the text is key to accessing and then addressing the mathematical question'.

Literacy education in Australia has been shaped over the years by many influences [2]; [3]; and [4]. Many publications promote their own views on what constitutes effective literacy education, and the different competences attributed to each theory. Whilst debate continues on which literacy program is more effective, it is widely agreed that literacy is an essential component of education.

Reciprocal teaching was first described by [5] in her dissertation thesis in 1982. The procedure was further refined Reciprocal teaching is an instructional procedure that was designed to improve reading comprehension. This is achieved by encouraging a group of students to work together to construct meaning and build understanding from a range of texts.

Improved reading comprehension, mathematical communication skills, ability to understand mathematical concepts, increase independence, writing ability and learning activities can also be improved by using reciprocal teaching strategies [6]. The advantage of reciprocal teaching strategy is that all centralized learning is centered on learning so that students are directly involved and will make students remember the concepts learned and can improve students' thinking skills[7]. Through reciprocal teaching learning strategy, students with positive self-concept can develop their abilities. It is because the steps on reciprocal teaching can give the best results supported by students' positive view of themselves [8].

Reciprocal teaching learning strategy conditions learning centered on students by exploring their abilities and potentials [9]. Reciprocal teaching strategy can be organized into learning activities to include those that emphasize student activity (student oriented).

Although every student knows how to read, many have never learned good reading skills. This lack of good reading skills is exacerbated by the central role of reading comprehension in the basic education success.

The ability to read and comprehend texts efficiently is crucial for mathematics students. In addition, because of the demanding expectations for academic success in all areas of learning, high-school students, need to develop their mathematical reading comprehension abilities to a stronger, more advanced level. Above discussions necessitate the conduct of this study among high school students.

FIGURES AND TABLES

Table 1

Pre – Test and Post – Test Performance of Students in Parallelogram in terms of Proving that Both Pairs of Opposite Sides are Congruent

Descriptive Rating	Score	Pre - Test		Post - Test	
		Frequency	Percent	Frequency	Percent
Advanced	9 - 10	5	4.85	10	9.71
Proficient	8	7	6.80	8	7.77
Approaching Proficiency	7	22	21.36	44	42.72
Developing	6	19	18.45	24	23.30
Beginning	0 - 5	50	48.54	17	16.50
	Total	103	100.00	103	100.00
Mean Interpretation		4.82 Beginning		6.34 Developing	

Table 1 shows the pre – test and post – test performance of students in parallelogram in terms of proving that both pairs of opposite sides are congruent.

Pre – Test. Out of 103 respondents, there were 5 or 4.85% whose scores are from 9-10; 7 or 6.80% obtained a score of 8; 22 or 21.36% obtained a score of 7; 19 or 18.45% obtained a score of 6; and 50 or 48.54% of the students scored from 0 – 5. The mean of the pre-test performance in parallelogram in terms of proving both pairs of opposite sides are congruent was 4.82 and interpreted as Beginning. This result means that the pre-test performance of the Grade 9 students was Beginning which signifies that the students' performance was poor in 'proving that both pairs of opposite sides are congruent'. The students do have limited knowledge and understanding because item 7 is very difficult (frequency 20, range 0.19), item 10 is also difficult (frequency 28, range 0.27) and item 8 is difficult (frequency 36, range 0.359). This was reflected in their mean of 4.82 with descriptive rating of Beginning.

Post – Test. Out of 103 respondents, there were 10 or 9.71% whose scores were from 9-10; 8 or 7.77% obtained a score of 8; 44 or 42.72% obtained a score of 7; 24 or 23.30% obtained a score of 6; and 17 or 16.50% of the students scored from 0 – 5. The mean of the post-test performance in parallelogram in terms of proving both pairs of opposite sides are congruent was 6.34 and interpreted as Developing. This result means that the post-test performance of the Grade 9 students was Developing which signifies that the students' performance in 'proving that both pairs of opposites sides are congruent' improved compared to pre-test result/score. In the

post-test, six of the ten items, the items 2, 3, 4 and 5 were very easy and items 1 and 6 were easy; and item is average Employing reciprocal teaching, the performance of the Grade 9 students improved on aspect of 'proving both pairs of opposite sides are congruent' such as identifying the quadrilateral given its properties; and condition that guarantee that a quadrilateral is a parallelogram.

[10] discussed how 10th grade students understand parallelograms. In their study, they have found that 81% of students correctly determine the parallelogram between given quadrilaterals. The study of [11] stressed that the use of reciprocal teaching can contribute to an increased awareness of parallelogram. When students are provided with appropriate learning environments, students are able to recognize the importance of quadrilaterals.

Table 2
Pre – Test and Post – Test Performance of Students in Parallelogram in terms of Proving that Both Pairs of Opposite Sides are Parallel

Descriptive Rating	Score	Pre - Test		Post - Test	
		Frequency	Percent	Frequency	Percent
Advanced	9 - 10	29	28.16	42	40.78
Proficient	8	23	22.33	17	16.50
Approaching Proficiency	7	23	22.33	27	26.21
Developing	6	17	16.50	11	10.68
Beginning	0 - 5	11	10.68	6	5.83
	Total	103	100.00	103	100.00
Mean Interpretation		7.28 Approaching Proficiency		7.82 Approaching Proficiency	

Table 2 shows the pre – test and post – test performance of students in parallelogram in terms of proving that both pairs of opposite sides are parallel.

Pre – Test. Out of 103 respondents, there were 29 or 28.16% whose scores were from 9-10; 8 or 22.33% obtained a score of 8 and 7 respectively; 17 or 16.50% obtained a score of 6; and 50 or 10.68% scored from 0 – 5. The mean of the pre-test performance in parallelogram in terms of proving both pairs of opposite sides are parallel was 7.28 interpreted as Approaching Proficiency. This result means that the pre-test performance of the Grade 9 students was Approaching Proficiency which signifies that the students perform quite well in proving both pairs of opposite sides are parallel. Items 11, 12, 13, 14 and 15 were very easy while items 16, 17 & 18 were easy; and the only very difficult item was item 20. The mean score of 7.28 obtained a descriptive rating of Approaching Proficiency.

Post – Test. Out of 103 respondents, there were 42 or 40.78% whose scores were from 9-10; 17 or 16.50% obtained a score of 8; 27 or 26.21% obtained a score of 7; 11 or 10.68% obtained a score of 6; and 6 or 5.83% of the students scored from 0 – 5. The mean of the post-test performance in parallelogram in terms of proving both pairs of opposite sides are parallel was 7.82 and interpreted as Approaching Proficiency. This result means that the post-test performance of the Grade 9 students was Approaching Proficiency. Items 11, 12, 13, 14 and 15 were very easy while items 16, 17 & 18 were easy; and the only very difficult item was item 20. The mean score of 7.82 obtained a descriptive rating of Approaching Proficiency. It also signifies that the students perform quite good in proving both pairs of opposite sides during pre-test specifically solving problems involving properties of parallelogram.

Employing reciprocal teaching, the performance of the Grade 9 students kept improving primarily on aspect of 'proving both pairs of opposite sides are parallel'. In the study of [12], parallelograms were given to students in order to gain in-depth knowledge about the conceptual learning of geometry. [13] revealed that the students in reciprocal teaching were offered opportunities to enable their exploration and understanding in parallelogram. Moreover, appropriate learning environments should be provided by considering students' thinking levels in teaching parallelograms.

Table 4 shows the pre – test and post – test performance of students in parallelogram in terms of proving that both pairs of opposite sides are both congruent and parallel.

Table 3
Pre – Test and Post – Test Performances of Students in Parallelogram in terms of Proving that Both Pairs of Opposite Sides are Both Congruent and Parallel

Descriptive Rating	Score	Pre - Test		Post - Test	
		Frequency	Percent	Frequency	Percent
Advanced	9 - 10	1	0.97	11	10.68

Proficient	8	6	5.83	10	9.71
Approaching Proficiency	7	14	13.59	50	48.54
Developing	6	20	19.42	22	21.36
Beginning	0 - 5	62	60.19	10	9.71
	Total	103	100.00	103	100.00
Mean Interpretation		4.18	Beginning	6.71	Developing

Pre – Test. Out of 103 respondents, there were 1 or 0.97% whose scores were from 9-10; 6 or 5.83% obtained a score of 8; 14 or 13.59% obtained a score of 7; 20 or 19.42% obtained a score of 6 and; 62 or 60.19% obtained a score ranging from 0-5. The mean of the pre-test performance in parallelogram in terms of proving both pairs of opposite sides are both congruent and parallel was 4.18 and interpreted as Beginning. This result means that the pre-test performance of the Grade 9 students was Beginning. This finding signifies that the students only scored from 5 to zero in proving that both pairs of opposite sides are both congruent and parallel. The students' scored low in this competency. Items 25 and 26 were difficult to very difficult items while items 22, 24, 27, 28, 29 and 30 were average in terms of its difficulty index. These are items of properties of parallelogram. It can be inferred that the students did not do well in this aspect of parallelogram.

Post – Test. Out of 103 respondents, there were 11 or 10.68% whose scores were from 9-10; 10 or 9.71% obtained a score of 8; 50 or 48.54% obtained a score of 7; 22 or 21.36% obtained a score of 6; and 10 or 9.71% obtained a score from 0 – 5. The mean of the post-test performance in parallelogram in terms of proving both pairs of opposite sides are both congruent and parallel was 6.71 and interpreted as Developing. This particular finding means that the post-test performance of the Grade 9 students improved from Beginning in the pre-test to Developing in the post-test.

Items 25 and 26 were difficult items; while items 21, 22, 27, and 30 were average; and items 23, 24, 28 and 29 were easy. It can be inferred that the students improved a bit in their post-test compared to their pre-test. Students' understanding and learning of proving that both pairs of opposite sides are both congruent and parallel improved from Beginning in the pre-test to Developing in the post-test. The use of reciprocal teaching may have contributed to this enhanced learning of 'proving that both pairs of opposite sides are both congruent and parallel' lesson/topic in parallelogram. The study of [11] observed the effect of reciprocal learning in teaching parallelograms.

Table 5 shows the pre – test and post – test performances of students in parallelogram in terms of proving that the diagonals of the quadrilateral bisect each other.

Pre – Test. Out of 103 respondents, there were 5 or 4.85% whose scores were from 9-10; 6 or 5.83% obtained a score of 8; 7 or 6.80% obtained a score of 7; 20 or 19.42% obtained a score of 6; and 65 or 60.19% scores from 0-5. The mean of the pre-test performance in parallelogram in terms of proving that the diagonals of the quadrilateral bisect each other was 4.15 interpreted as Beginning.

Table 4
Pre – Test and Post – Test Performances of Students in Parallelogram in terms of Proving that the Diagonals of the Quadrilateral Bisect each Other

Descriptive Rating	Score	Pre - Test		Post - Test	
		Frequency	Percent	Frequency	Percent
Advanced	9 - 10	5	4.85	16	15.53
Proficient	8	6	5.83	5	4.85
Approaching Proficiency	7	7	6.80	46	44.66
Developing	6	20	19.42	24	23.30
Beginning	0 - 5	65	63.11	12	11.65
	Total	103	100.00	103	100.00
Mean Interpretation		4.15	Beginning	6.68	Developing

This result means that the pre-test performance of the Grade 9 students was Beginning which signifies that the students' score in 'proving that the diagonals of the quadrilateral bisect each other' was only from a range of five to zero. The mean score (4.15) suggests that the students performed poorly in this area of parallelogram mainly solving problem involving trapezoid. Item 36 was very difficult item; items 34, 35 and 40 were difficult; and items 33, 37 and 39 were average. It seems that the students found their pre-test in proving that the diagonals of the quadrilateral bisect each other difficult to solve for their obtained level of performance was interpreted as Beginning.

Post – Test. Out of 103 respondents, there were 16 or 15.53% whose scores were from 9-10; 5 or 4.85% obtained a score of 8; 46 or 44.66% obtained a score of 7; 24 or 23.30% obtained a score of 6; and 12 or 11.65% obtained a score from 0 – 5. The mean of the post-test performance in parallelogram in terms of proving that the diagonals of the quadrilateral bisect each other was 6.68 interpreted as Developing.

The only difficult item in the post-test was item 36; items 34, 37, 38, 39, and 40 were found to be average; and items 32 and 33 were easy items in the post-test. There were more items which are average and easy compared to pre-test. This result means that the post-test performance of the Grade 9 students was Developing which signifies that the students' performance in proving that the diagonals of the quadrilateral bisect each other' (e.g., solving problem involving trapezoid) improved from Beginning in the pre-test to Developing in the post-test.

Employing reciprocal teaching, the performance of the Grade 9 students improved primarily on aspect of 'proving that the diagonals of the quadrilateral bisect each other'. In the study of [14], the students can determine the hierarchical relationship of parallelograms with other quadrilaterals. Students were also found to be more successful in determining the hierarchical relationship of other parallelograms. Teaching parallelograms in geometry using the reciprocal learning approach has effect on student achievement [15]. The study showed that this approach is more effective than the traditional method by relying on the findings of their research conducted on the basis of problem based learning, brain storming, and cooperative learning.

Table 6 shows the pre – test and post – test performances of students in parallelogram in terms of proving the pairs of opposite angles are congruent.

Pre – Test. Out of 103 respondents, there were 20 or 19.42% whose scores were from 9-10; 8 or 7.77% obtained a score of 8; 15 or 14.56% obtained a score of 7; 6 or 8.74% obtained a score of 6; and 51 or 49.51% obtained a score ranging from 0 – 5. The mean of the pre-test performance in parallelogram in terms of proving the pairs of opposite angles are congruent was 5.25 interpreted as Beginning.

Table 5

Pre – Test and Post – Test Performances of Students in Parallelogram in terms of Proving the Pairs of Opposite Angles are Congruent

Descriptive Rating	Score	Pre - Test		Post - Test	
		Frequency	Percent	Frequency	Percent
Advanced	9 - 10	20	19.42	37	35.92
Proficient	8	8	7.77	17	16.50
Approaching Proficiency	7	15	14.56	32	31.07
Developing	6	9	8.74	9	8.74
Beginning	0 - 5	51	49.51	8	7.77
	Total	103	100.00	103	100.00
Mean Interpretation		5.25 Beginning		7.63 Approaching Proficiency	

This result means the Grade 9 students did not perform well 'proving the pairs of opposite angles are congruent'. The students have a very poor performance in proving the pairs of opposite angles are congruent, manifested in the mean score of 5.25 described as Beginning. Most of the items (items 43, 45, 46, and 49) were interpreted as very difficult; while items 41, 42 and 44 were difficult for the students; and the only very easy item was item 50. It seems that the students found their pre-test in 'proving the pairs of opposite angles are congruent' was not easy to solve for their obtained level of performance was interpreted as Beginning.

Post – Test. Out of 103 respondents, there were 37 or 35.92% whose scores were from 9-10; 17 or 16.50% obtained a score of 8; 32 or 31.07% obtained a score of 7; 9 or 8.74% obtained a score of 6; and 8 or 7.77% obtained a score ranging from 0 – 5. The mean of the post-test performance in parallelogram in terms of proving the pairs of opposite angles are congruent was 7.63 interpreted as Approaching Proficiency. This result means that the post-test performance of the Grade 9 students was Approaching Proficiency. There were only two items which were remarked as average (items 45 and 50); items 41, 21, and were very easy; and items 44, 46, 47, 48, and 49 were easy. There were more items which are very easy to easy in the post test compared to pre-test. This result signifies that the students' performance in 'proving the pairs of opposite angles are congruent' improved from Beginning in the pre-test to Approaching Proficiency in the post-test. The utilization of reciprocal teaching may have caused the improvement in the performance of the Grade 9 students in 'proving the pairs of opposite angles are congruent' aspect of parallelogram. According to [16], using reciprocal teaching, the students can monitor their own thinking through the reading process. Reciprocal teaching helps students to reach the most important goal of reciprocal teaching, becoming independent readers. [19] revealed that students can explain adequately when they look at the mathematical explanations about this situation. This result showed that students encounter problem on parallelogram showing congruency.

Table 7 shows the students' performance in parallelogram during pre – test and post – test.

As can be seen in the Table 7 that the pre – test, proving that both pairs of opposite sides are parallel obtained a descriptive rating of Approaching Proficiency level of performance with an overall weighted mean (OWM) of 7.28 (rank 1). Proving that both pairs of opposite angles are congruent (OWM=5.25, rank 2); proving that both pairs of opposite sides are congruent (OWM=4.82, rank 3); proving that both pairs of opposite sides are both congruent and parallel (OWM=4.18, rank 4); and proving that the diagonals of the quadrilateral bisect each other (OWM=4.15, rank 5); all obtained a descriptive rating of Beginning. The overall mean for pre - test was 5.14 with descriptive rating of Beginning.

Table 6
Summary of Students' Performances in Parallelogram during the
Pre – Test and Post – Test

	Pre - Test			Post - Test		
	Mean	Descriptive Rating	Rank	Mean	Descriptive Rating	Rank
Proving that Both Pairs of Opposite Sides are Congruent	4.82	Beginning	3	6.34	Developing	5
Proving that Both Pairs of Opposite Sides are Parallel	7.28	Approaching Proficiency	1	7.82	Approaching Proficiency	1
Proving that Both Pairs of Opposite Sides are Both Congruent and Parallel	4.18	Beginning	4	6.71	Developing	3
Proving that the Diagonals of the Quadrilateral Bisect Each Other	4.15	Beginning	5	6.68	Developing	4
Proving the Pairs of Opposite Angles are Congruent	5.25	Beginning	2	7.63	Approaching Proficiency	2
Overall Weighted Mean	5.14	Beginning		7.04	Approaching Proficiency	

During the post – test, the level of performance in proving that both pairs of opposite sides are parallel and proving the pairs of opposite angles are congruent has a descriptive rating of approaching proficiency with an overall weighted mean (OWM) of 7.82 (rank 1) and 7.63 (rank 2) respectively. On the other hand, parameter proving that both pairs of opposite sides are both congruent and parallel (OWM=6.71, rank 3); proving that the diagonals of the quadrilateral bisect each other (OWM=6.68, rank 4); and proving that both pairs of opposites sides are congruent (OWM=6.34, rank 5); all obtained a descriptive rating of Developing respectively. The overall mean for post - test was 7.04 interpreted as Approaching Proficiency.

The students' performance in learning parallelogram during the pre-test was Beginning (OWM=5.14) while the post-test performance was Approaching Proficiency (OWM=7.04). The result signifies that there was progress on the academic performance of the Grade 9 students from pre-test to post-test. The teachers have utilized the suitable approach or strategy in teaching parallelogram, making the students learn further this topic in Mathematics. [16] Erwanto, Sri Maryatmi and Budiyanto (2018) proved that the reciprocal teaching model influence more the problem-solving abilities of the learners. [17] Argikas and Khuzaini (2016) stressed that the reciprocal teaching model has been used to improve comprehension for students who can decode but have difficulty comprehending text. [18] Konpan (2006) revealed that reciprocal instruction allows a teacher to model and give the students enough practice to construct the meaning of a text or the problem.

Test of Difference on the Students' Performance in the Pre – Test and Post – Test in Parallelogram

Table 8 shows the test of difference between pre – test and post – test results of Grade 9 students in parallelogram.

The sig. values for proving that both pairs of opposite sides are congruent; proving that both pairs of opposite sides are parallel; proving that both pairs of opposite sides are both congruent and parallel; proving that the diagonals of the quadrilateral bisect each other; and proving the pairs of opposite angles are congruent of (0.00) were lower than 0.05 alpha levels of significance, therefore the null hypothesis is rejected.

Table 7
Test of Difference on the Level of Performances of the Students in Parallelogram between Pre – Test and Post – Test

	t	df	Sig. (2-tailed)	Decision/ Interpretation
Proving that Both Pairs of Opposite Sides are Congruent	-5.60	102	0.00	Reject Ho Significant
Proving that Both Pairs of Opposite Sides are Parallel	-3.31	102	0.00	Reject Ho Significant
Proving that Both Pairs of Opposite Sides are Both Congruent and Parallel	-10.38	102	0.00	Reject Ho Significant
Proving that the Diagonals of the Quadrilateral Bisect Each Other	-9.86	102	0.00	Reject Ho Significant
Proving the Pairs of Opposite Angles are Congruent	-7.63	102	0.00	Reject Ho Significant

There was a significant difference on the students' performances on pre – test and post – test in proving that both pairs of opposite sides are congruent; in proving that both pairs of opposite sides are parallel; in proving that both pairs of opposite sides are both congruent and parallel; in proving that the diagonals of the quadrilateral bisect each other; and in proving the pairs of opposite angles are congruent. The performances/scores in the pre-test of the students in parallelogram differ from the performances/scores in their post-test which was given after the usage/utilization of the reciprocal teaching approach. It was found in the study of [11] that students were academically successful when taught in reciprocal teaching than the traditional teaching methods since there was a rise in success in students' results. [14] revealed that reciprocal model turns the student from a passive recipient to an active self-learner and problem solver shifting the emphasis of educational programs from teaching to learning.

CONCLUSION

The pre-test performance of the students in parallelogram in terms of proving that both pairs of opposite sides are parallel was Approaching Proficiency, however, proving that both pairs of opposite sides are congruent; proving that both pairs of opposite sides are both congruent and parallel; proving that the diagonals of the quadrilateral bisect each other; and proving the pairs of opposite angles are congruent parameter was Beginning

The post-test performance of the students in terms of proving that both pairs of opposite sides are parallel and proving the pairs of opposite angles are congruent was Approaching Proficiency. On the other hand, proving that both pairs of opposite sides are congruent; proving that both pairs of opposite sides are both congruent and parallel; and proving that the diagonals of the quadrilateral bisect each other was Developing.

There was a significant difference on the students' performances on pre – test and post – test in proving that both pairs of opposite sides are congruent; in proving that both pairs of opposite sides are parallel; in proving that both pairs of opposite sides are both congruent and parallel; in proving that the diagonals of the quadrilateral bisect each other; and in proving the pairs of opposite angles are congruent.

Mathematics teachers may take the opportunities and occasions to improve and enhance skills and knowledge of utilization of reciprocal teaching in Mathematics instruction in the secondary level of basic education.

Mathematics teachers in secondary schools may utilize further the reciprocal teaching and other teaching pedagogies and learning activities aimed for the students to further learn parallelogram primarily proving that both pairs of opposite sides are congruent; proving that both pairs of opposite sides are both congruent and parallel; and proving that the diagonals of the quadrilateral bisect each other.

The public secondary school may introduce the use of reciprocal teaching to learners in the Junior and Senior High school levels.

The public secondary school may formulate policies that would encourage teachers to utilize reciprocal teaching approach for their classes to maximize teachers' potential in making more effective strategies.

The Mathematics teachers are encouraged to conduct an in – depth study on the effect of reciprocal teaching other teaching pedagogies in Mathematics in other year levels (Junior and Senior High school) in secondary schools.

REFERENCES

- [1] Marzano, R. J. (2005). *Building academic vocabulary: Teacher's manual*. Alexandria, VA: Association for Supervision and Curriculum Development.
- [2] Alvermann, D. E. (2001). *Effective Literacy Instruction for Adolescents*. Executive summary and paper commissioned by the National Reading Conference. National Reading Conference. Chicago, IL.
- [3] Harvey, S. & Goudvis, A. (2000). *Strategies that work: Teaching comprehension to enhance understanding*. Stenhouse Publishers, USA.
- [4] Ludwig, C. (2000). *Literacy in the learning areas: A proposition*. Literacy Learning, the Middle Years 8.1
- [5] Palincsar, A. S. & Brown, A., (1984) Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction*, 1984, I (2) 117-175.
- [6] Jitendra, A. K., Harwell, M. R., Dupuis, D. N., & Karl, S. R. (2016). A Randomized Trial of The Effects of Schema Based Instruction on Proportional Problem Solving for Students With Mathematics Problem Solving Difficulties. *Journal of Learning Disabilities*, 50(3), 1–15.
- [7] Wahyuni, R., & Efuansyah. (2018). Model Pembelajaran Missouri Mathematics Project (MMP) Menggunakan Strategi Think Talk Write (TTW) Terhadap Kemampuan Berpikir Kritis dan Kemampuan Pemecahan Masalah. *Jurnal Nasional Pendidikan Matematika*, 2(1), 24–36.
- [8] Cowan, J. (2017). The Potential of Cognitive Think Aloud Protocols for Educational Action Research. *Active Learning in Higher Education*, 1–14.
- [9] Morin, L. L., Watson, S. M. R., Hester, P., & Raver, S. (2017). The Use of a Bar Model Drawing to Teach Word Problem Solving to Students With Mathematics Difficulties. *Learning Disability Quarterly*, 40(2), 1–14.
- [10] Aktaş, M. C. & Aktas, S. (2012). Turkish adaptation of attitude towards mathematics instrument. *Journal of Theory and Practice in Education*, 11(1), 245–260
- [11] Saliba, M.T. (2015). A Pedagogical Synergy of Visualization Pictures and Scenarios to Teach the Concept of Parallelograms. *International Journal of Learning, Teaching and Educational Research* Vol. 11, No. 2, pp. 26-39, May 2015
- [12] Ergün, S. (2010). 7th grade students' perception, definition and classification of the polygons]. Unpublished master thesis. Dokuz Eylül Üniversitesi, Eğitim Bilimleri Enstitüsü, İzmir.
- [13] Dane, A., & Başkurt, H. (2011). Primary school the 6th, 7th and 8th grade students' perceptions on line segment, linearity, ray and angle concepts. *Erzincan Eğitim Fakültesi Dergisi*, 13(2), 85-104.
- [14] Akkaş, E. N., & Türnüklü, E. (2015). Middle school mathematics teachers' pedagogical content knowledge regarding student knowledge about quadrilaterals. *İlköğretim Online*, 14(2), 744-756.
- [15] Akınoğlu, O. Özkardeş, R. (2007). The Effects of Problem-Based Active Learning in Science Education on Students' Academic Achievement, Attitude and Concept Learning. *Psychology Eurasia journal of mathematics, science and technology education* Published 2007
- [16] Erwanto, Sri Maryatmi, A. & Budiyanto, A. (2018). The Effects of Reciprocal Teaching Learning Strategy and Self efficacy on Learning Outcomes of Early Childhood (AUD) Mathematical Logic. *Al-Jabar: Jurnal Pendidikan Matematika* Vol. 9, No. 1, 2018, Hal 41 – 50
- [17] Argikas & Khuzaini (2016). A Randomized Trial of the Effects of Schema Based Instruction on Proportional Problem Solving for Students With Mathematics Problem Solving Difficulties. *Journal of Learning Disabilities*, 50(3), 1–15.
- [18] Konpan, T. (2006). A comparison of reciprocal teaching technique and communicative teaching technique in developing Mattayom Suksa 4 Students' Reading Comprehension. Unpublished master dissertation, Srinakarinwirot University, Thailand.
- [19] Özkan, M. (2015). Analysing the misconceptions that students have about polygon and special quadrilaterals. Unpublished master thesis. Çukurova Üniversitesi, Sosyal Bilimler Enstitüsü, Adana.