Mathematical Fluency and Problem Solving Skills through a Reflective Practice Learning Approach

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ABSTRACT

The Reflective Practice Learning Approach (RPLA) was a learner-centered teaching approach that enhances students' mathematical fluency and problem-solving skills, as well as reflective and meaningful learning experiences that encourage them to examined and improved their thinking. This study employed a quasi-experimental research design to determine the effect of the Reflective Practice Learning Approach (RPLA) on the mathematical fluency and problem-solving skills of Grade 11 students at Kiburiao National High School during the third quarter of School Year 2025–2026, and to identify significant differences between the RPLA and non-RPLA groups in terms of posttest and retention test results. A total of 61 students participated, with 30 in the RPLA group and 31 in the non-RPLA group. Both groups initially demonstrated low to very low levels of mathematical fluency and problem-solving skills in the pretest. After the intervention, both groups improved in the posttest and retention test, with the RPLA group showing greater gains than the non-RPLA group. The RPLA group achieved a high level of mathematical fluency and demonstrated better retention of skills over time, while the non-RPLA group remained at an average level. In problem-solving skills, both groups improved, but the RPLA group performed better and showed stronger retention. Thus, posttest and retention results indicated that the RPLA group outperformed the non-RPLA group in both domains. Reflective practice learning activities should be integrated into mathematics instruction to enhance and sustain learners' mathematical fluency and problem-solving skills.

Keywords: Reflective Practice Learning Approach, mathematical fluency, problem-solving skills

INTRODUCTION

Mathematics is a vital discipline that underpins the advancement of science, technology, and economics, forming the backbone of innovations that shape modern society. Its application extends beyond academic boundaries, influencing decision-making, logical reasoning, and real-world problem-solving. A solid foundation in mathematics equips students with analytical thinking skills essential for personal and professional (Duma et al., 2024). In the 21st century, global competitiveness demands not only the ability to perform computations but also the capacity to apply mathematical concepts fluently and effectively in diverse situations (Assencio et al., 2015). Without such skills, learners may find themselves unprepared for the challenges of higher education, the workplace, and everyday life.

Mathematical fluency refers to the ability to recall facts, compute accurately, and apply procedures efficiently serving as a critical foundation for higher-order thinking and problem-solving (Tikhomirova & Malykh, 2017). Fluency enables students to allocate more cognitive resources to understanding and tackling complex problems, instead of struggling with fundamental calculations. However, this alone is not sufficient; effective problem solving in mathematics requires not just fluency, but also the capability to analyze situations, identify patterns, and devise strategies for solutions (Kaskens et al., 2022). These elements are interconnected: fluency supports efficient problem-solving, while problem-solving provides meaningful contexts for developing deeper fluency.

Many students, however, can perform basic mathematical operations yet experience difficulty applying them in unfamiliar or complex scenarios (Viterbori et al., 2017).

The performance of Filipino students in mathematics remains a critical concern for educators, policymakers, and stakeholders. International assessments, particularly the Programme for International Student Assessment (PISA), consistently show low proficiency levels among Filipino students. In PISA 2022, 15-year-olds in the Philippines scored an average of 355 points in mathematics, substantially lower than the OECD average of 472 points (OECD, 2023; Education GPS, 2022). Locally, the National Achievement Test (NAT) results reflect a similar pattern of underperformance. In the Division of Bukidnon, the mean percentage score (MPS) in mathematics has been around 41.73% in recent assessments, categorized as "Average Mastery" but still below the desired proficiency levels. These consistent low scores underscore the persistent challenge in achieving mastery in mathematics in many divisions, including Bukidnon (DepEd Bukidnon Division, 2025; Bukidnon Division Education Development Plan, 2017–2022). This underscores the urgent need for innovative teaching methodologies such as the Reflective Practice Learning Approach that enhance mathematical fluency and strengthen students' problem-solving skills beyond rote memorization.

To address these gaps, innovative teaching approaches are necessary. The Reflective Practice Learning Approach (RPLA) offers a promising framework by integrating experience, reflection, and critical analysis of problem-solving strategies into mathematics instruction. Unlike traditional models that focus primarily on procedure, RPLA encourages students to reflect on their thinking, identify errors, and adopt more effective strategies, fostering both higher mathematical fluency and improved problem-solving skills (Schön, 1983; Dewey, 1933). Through guided reflection, students can evaluate their problem-solving strategies, identify errors, and make informed adjustments, leading to a deeper understanding of concepts and improved mathematical reasoning (Henderson et al., 2023). RPLA also encourages metacognitive awareness helping learners understand not only how to solve problems but also why certain solutions work thereby promoting the transfer of learning to new and complex situations. By integrating reflective practices into mathematics instruction, teachers can cultivate habits of self-assessment, adaptability, and continuous improvement in their students.

Despite the recognized benefits of reflective practice in teacher education and professional development, its structured application in mathematics classrooms remains limited in Philippine secondary education. There is a clear need for research exploring how integrating reflective practices with mathematics instruction—specifically through RPLA—can support students in developing both fluency and problem-solving skills.

This study seeks to fill this gap by investigating the effect of the Reflective Practice Learning Approach on students' mathematical fluency and problem-solving skills. It will be conducted at Kiburiao National High School during the third quarter of School Year 2025–2026. Specifically, it aims to determine whether embedding reflection into mathematics instruction can significantly improve learners' ability to solve both routine and non-routine problems while maintaining high levels of fluency. The findings of this research are expected to provide valuable insights for mathematics educators, curriculum developers, and policymakers in designing interventions that enhance both skill mastery and higher-order thinking in mathematics.

Statement of the Problem

This study aimed to assess the effect of the Reflective Practice Learning Approach (RPLA) on the mathematical fluency and problem-solving skills of Grade 11 Senior High School students in mathematics.

Specifically, this study sought to answer the following questions:

1. What is the level of students' mathematical fluency when exposed to RPLA and those exposed to Non-RPLA as measured by the:

a. pre-test scores;

b. post-test scores; and

c. retention test scores?

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2. What is the level of students' problem solving skills in mathematics when exposed to RPLA and those exposed to Non- RPLA as measured by the:

   a. pre-test scores;

   b. post-test scores; and

   c. retention test scores?

3. Is there a significant difference between the mathematical fluency of students when exposed to RPLA and those exposed to non-RPLA using pre-test as a covariate?

4. Is there a significant difference between the mathematical problem solving skills of students when exposed RPLA and those exposed to non-RPLA using pre-test as a covariate?

Hypothesis of the Study

The following hypotheses was tested at 0.05 level of significance:

H_{01}: There is no significant difference between mathematical fluency when exposed to RPLA and those exposed to non-RPLA, considering pretest as a covariate, in terms of:

a. posttest and

b. retention test.

H_{02}: There is no significant difference between the level problem-solving skills of the students exposed to RPLA and those exposed to non-RPLA, considering pretest as a covariate, in terms of:

a. posttest and

b. retention test.

Scope and Delimitation of the Study

This study focuses on examining the effect of the Reflective Practice Learning Approach (RPLA) on the mathematical fluency and problem-solving skills of Grade 11 Senior High School students. Specifically, it investigated how integrating reflective learning cycles experience, reflection, conceptualization, and application can enhance students' ability to perform computations accurately and solve routine problems effectively. The participants of this study were two intact sections of Grade 11 students from Kiburiao National High School, Kiburiao, Quezon, Bukidnon, during the second grading period of the School Year 2025–2026. The lessons will be anchored on selected topics in General Mathematics, particularly basic business mathematics and logic.

The intervention was implemented over an eight-week period, which students was undergoing a pre-test, post-test, and retention test to measure their progress and retention of skills. This study employed a quasi-experimental research design to determine whether there is a significant difference in the mathematical fluency and problem-solving skills of students exposed to RPLA compared to those who are not. The findings of this study were limited to the specified participants, topics, and duration, and thus generalizations beyond similar contexts should be made with caution.

METHODOLOGY

Research Design

This study employed a quantitative research approach, specifically a quasi-experimental research design, to examined the effect of the Reflective Practice Learning Approach (RPLA) on the mathematical fluency and

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problem-solving skills of Grade 11 Senior High School students. The quasi-experimental design was deemed appropriate as it allows for the comparison of outcomes between groups without the need for random assignment, which was not feasible in the school setting due to the use of intact classes.

Locale of the Study

The study was conducted at Kiburiao National High School, located in Barangay Kiburiao, Municipality of Quezon, Bukidnon, under the Quezon III District of the Department of Education (DepEd) Division of Bukidnon in the Philippines. The school was one of the larger secondary institutions in the division in terms of student population and teaching staff. At the time of the study, it had an enrollment of approximately 1,500 students and a workforce of 65 teaching and non-teaching personnel. Kiburiao National High School offers a complete Junior and Senior High School program, including the Academic, Technical-Vocational-Livelihood (TVL), and Science, Technology, Engineering, and Mathematics (STEM) strands.

In recent years, the school had recorded consistently low performance in mathematics, as reflected in the results of quarterly assessments and the National Achievement Test (NAT). These results revealed students' difficulties in both procedural fluency and problem-solving, particularly in applying concepts to routine situations. Mathematics teachers in the school have recognized the need for innovative instructional strategies to address these challenges, making the conduct of this study on the Reflective Practice Learning Approach (RPLA) both timely and relevant.

Research Participants

The participants of the study were the two intact sections of Grade 11 Senior High School students from Kiburiao National High School for the School Year 2025–2026, who are enrolled in Statistics and Probability during the third grading period. One section was served as the experimental group, which received instruction through the Reflective Practice Learning Approach (RPLA), while the other section served as the control group, which was taught using conventional instructional methods.

The students, typically aged 16 to 18, reflect the general demographic of the Grade 11 level at the school and represent a mix of male and female learners. Grade 11 was specifically chosen because students at this stage are developmentally capable of engaging in higher-order thinking and reflective processes. Their cognitive maturity enables them to participate effectively in the cyclical phases of RPLA experiencing, reflecting, conceptualizing, and applying making them well-suited for investigating how this approach influences their mathematical fluency and problem-solving skills.

Research Instruments

The study utilized two instruments to measure students' mathematical fluency and mathematical problem-solving skills. A standardized mathematics test developed and validated by the Department of Education Regional Office was adapted to assess students' mathematical fluency. This test measured both speed and accuracy in solving mathematical problems aligned with the competencies in the Statistics and Probability curriculum.

Students' performance in mathematical fluency was computed using a formula that equally consider accuracy and speed to ensure a balanced measure of proficiency. The accuracy score was determined by the percentage of correctly answered items out of the total number of questions. This reflects how precise and correct the student's responses are. The speed was measured based on the time students take to complete the test relative to the allotted duration. Students who finish faster receive higher speed scores, while those who take longer receive lower scores. After obtaining both scores, the formula combines them by taking their average. This means that the Mathematical Fluency Score gives equal importance to both correctness and speed, providing a balanced measure of a student's ability to solve mathematical problems accurately and efficiently. This was pilot tested before the researcher utilized the instrument, with a Cronbach's Alpha of 0.788.

Mathematical Fluency scores from the pretest, posttest, and retention test were analyzed using an adapted scale developed by Aisyah et al. (2022).

Level of Mathematical Fluency

Score	Percentage Equivalent	Description	Qualitative Interpretation
86-100	86%-100%	Excellent	Very High Mathematical Fluency
71-85	71%-85%	Good	High Mathematical Fluency
56-70	56%-70%	Fair	Average Mathematical Fluency
41-55	41%-55%	Poor	Low Mathematical Fluency
0-40	0-40%	Very Poor	Very Low Mathematical Fluency

The assessment of mathematical problem-solving skills was carried out using a researcher-made test composed of four (4) problem sets aligned with the learning competencies in Statistics and Probability. Each problem was designed to measure students' ability to comprehend the problem, select appropriate strategies, apply relevant mathematical concepts, and arrive at accurate solutions. The test was subjected to content validation by a panel of experts in mathematics education and research to ensure the clarity, relevance, and alignment of the items with the intended learning outcomes. After the validation process, the instrument underwent a pilot test among a comparable group of Grade 12 students to determine its reliability using appropriate statistical methods. The validated and reliable test was then used as the pre-test, post-test, and retention test to evaluate the improvement of students' mathematical problem-solving skills after exposure to the Reflective Practice Learning Approach (RPLA). This was pilot tested before the researcher utilized the instrument, with a Cronbach's Alpha of 0.81.

The scores were transmuted and interpreted using the scale below, adapted from the standards set in DepEd Order No. 8, Series of 2015.

Score	Percent Equivalent	Descriptive Rating	Qualitative Interpretation
40 – 50	90-100	Very High	Outstanding
36 – 39	85-89	High	Very Satisfactory
30 – 35	80-84	Average	Satisfactory
25 – 29	75-79	Low	Fairly Satisfactory
0 - 24	Below 75	Very Low	Did not meet expectations

Data Gathering

A request letter was sent to the Schools Division Superintendent of the Division of Bukidnon through the principal of Kiburiao National High School, seeking permission to conduct the study on Grade 11 students during the third grading period of the school year 2025–2026. In addition, the research content was submitted to the REC for review and approval.

Before the implementation, the objectives of the study were explained to the student participants. An informed consent form was provided to each student, detailing their participation in every stage of the study, from taking the pretest to engaging in discussions, completing activities, and taking the posttest and retention test. Participation was voluntary, and both the students and their parents were asked to sign the consent form to indicate their understanding and agreement to take part. The researcher assured the participants that all information they provided would be treated with strict confidentiality.

The pretest was administered to both groups before the start of the intervention to determine their baseline knowledge and skills in mathematics. One group was exposed to the Reflective Practice Learning Approach (RPLA), while the other was exposed to non-RPLA strategies over the agreed period. After the intervention, a posttest was conducted to measure the immediate learning gains of each group. Two weeks later, a retention test was given to both groups to assess the extent of knowledge retention. The pretest, posttest, and retention test scores were analyzed to compare the academic performance of students exposed to RPLA and those exposed to non-RPLA strategies.

Data Analysis

The researcher utilized descriptive statistics, including frequency, mean, percentage and standard deviation, to determine the level of students' mathematical fluency and problem-solving skills. Prior to the inferential analysis, the assumptions for parametric tests were conducted. The Shapiro–Wilk test was used to determine whether the data gathered was normally distributed, and Levene's test was used to assess the homogeneity of variances. If the results revealed that the data is normally distributed and the homogeneity assumption was met, the researcher proceed with the Analysis of Covariance (ANCOVA). ANCOVA employed to assess whether there was a significant difference in the mathematical fluency and problem-solving skills between Grade 11 students at Kiburiao National High School who was exposed to the Reflective Practice Learning Approach (RPLA) and those who was exposed to non-RPLA instruction. The analysis was based on students' pre-test, post-test, and retention test scores.

Ethical Consideration

To formally initiate the study, the researcher ensured compliance with established ethical research protocols as reflected in the conduct of the study presented in the manuscript. Prior to the actual data gathering, approval was secured from the Research Ethics Committee (REC) of the university. After the REC approval was granted, the researcher proceeded with the administration of the research instruments to the selected respondents. An ethics statement was provided to all participants, clearly explaining the purpose of the study, the procedures involved, and the ethical principles observed throughout the research. This included informed consent, ensuring that participation was voluntary and that respondents had the right to refuse participation or withdraw from the study at any time without any form of penalty or negative consequence.Confidentiality and anonymity were strictly observed, with assurances that all responses would be kept private, securely stored, and used solely for research purposes. The ethics statement, together with the letter of permission and the REC approval, was properly submitted to the Schools Division Office and concerned school authorities prior to data collection. Approval was likewise coordinated with the school administrators, principals, and subject teachers involved in the implementation of the study. To further ensure ethical compliance, participants' identities were not disclosed at any point in the study, maintaining full anonymity throughout the research process.

DISCUSSION OF THE FINDINGS

The table shows that both the Reflective Practice Learning Approach (RPLA) and non-Reflective Practice Learning Approach (non-RPLA) groups started with very low mathematical fluency during the pre-test. In the RPLA group, 25 or 83.3% of the learners were classified under low mathematical fluency, while 5 or 16.7% were under very low mathematical fluency. The group obtained a mean score of 44.4, equivalent to a mean percentage score (MPS) of 44.4%, interpreted as very low mathematical fluency. Similarly, in the non-RPLA group, 17 or 54.8% of the learners had very low mathematical fluency, while 14 or 45.2% had low mathematical fluency. The group obtained a mean score of 39.87, equivalent to an MPS of 39.87%, also interpreted as very low mathematical fluency. These findings indicate that both groups had limited mathematical skills and were relatively comparable before the intervention. After the implementation of the interventions, both groups improved in their post-test performance. The RPLA group obtained a mean score of 67.9 or an MPS of 67.9%, interpreted as average mathematical fluency, with 14 or 46.7% of the learners classified under high mathematical fluency, 15 or 50% under average mathematical fluency, and 1 or 3.3% under low mathematical fluency.

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Meanwhile, the non-RPLA group obtained a mean score of 61 or an MPS of 61%, also interpreted as average mathematical fluency. In this group, 19 or 61.3% of the learners had average mathematical fluency, 7 or 22.6% had low mathematical fluency, while a small portion remained under very low mathematical fluency.

Table 1. Level of Students' Mathematical Fluency

GROUP												
SCORE	Pretest				Posttest				Retention test			
	RPLA		Non-RPLA		RPLA		Non-RPLA		RPLA		Non-RPLA	
	f	%	f	%	f	%	f	%	f	%	f	%
86-100	0	0	0	0	0	0	0	0	0	0	0	0
71-85	0	0	0	0	14	46.7	5	16.1	19	63.3	7	22.6
56-70	0	0	0	0	15	50	19	61.3	11	36.7	18	58.1
41-55	25	83.3	14	45.2	1	3.3	7	22.6	0	0	6	19.4
0-40	5	16.7	17	54.8	0	0	0	0	0	0	0	0
MPS	44.4		39.87		67.9		61		70.3		62	
VLMF			VLMF		AMF		AMF		HMF		AMF	

Legend:			
	Percentage Equivalent 86%-100%	Description Excellent	Qualitative Interpretation Very High Mathematical Fluency (VHMF)
	71-85%	Good	High Mathematical Fluency (HMF)
	56-70%	Fair	Average Mathematical Fluency (AMF)
	41%-55%	Poor	Low Mathematical Fluency (LMF)
	0-40%	Very Poor	Very Low Mathematical Fluency (VLMF)

The retention test results indicate improvement in both groups; however, the RPLA group consistently outperformed the non-RPLA group in mathematical fluency. In the RPLA group, 19 learners (63.3%) achieved high fluency, while 11 (36.7%) were classified as average, yielding a mean score of 70.3 (MPS = 70.3%), interpreted as high mathematical fluency. In contrast, the non-RPLA group obtained a mean score of 62 (MPS = 62%), interpreted as average mathematical fluency, with 7 learners (22.6%) at the high level, 18 (58.1%) at the average level, and 6 (19.4%) at the low level. Overall, although both groups demonstrated gains from pre-test to retention test, the RPLA group showed more favorable performance distribution and higher overall achievement, suggesting stronger retention of mathematical fluency skills compared to the non-RPLA group.

The improvement observed in both groups may be attributed to structured instruction, guided practice, and repeated exposure to mathematical tasks. Fuchs et al. (2016) emphasized that mathematical fluency develops through repeated practice supported by feedback, while Seethaler et al. (2019) noted that systematic instructional sequences enhance computational accuracy and procedural understanding. Similarly, Gersten et al. (2015) highlighted that guided instruction reduces computational errors and strengthens foundational mathematical

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skills. Van de Walle et al. (2019) further explained that fluency is strengthened when procedural practice is integrated with conceptual understanding, which may help explain the relatively stronger performance of the RPLA group. In addition, Powell et al. (2017) and Shin et al. (2024) underscored that sustained practice and repetition contribute to long-term retention of mathematical skills. Likewise, Carriaga-Baril and Abapo (2025) found that targeted instructional interventions improve accuracy, efficiency, and retention, collectively reinforcing the effectiveness of the Reflective Practice Learning Approach in promoting deeper understanding and sustained mathematical fluency.

Table 2 shows that both the Reflective Practice Learning Approach (RPLA) and non-Reflective Practice Learning Approach (non-RPLA) groups began with very low problem-solving skills in Mathematics during the pre-test. In the RPLA group, 26 or 86.7% of the 30 learners were classified as having very low problem-solving skills, 1 or 3.3% obtained a very high score, 2 or 6.7% achieved a high score, 1 or 3.3% obtained a moderate score, and none fell under the low category. The group obtained a mean score of 12.07, equivalent to a mean percentage score (MPS) of 24%, interpreted as very low problem-solving skills. Meanwhile, in the non-RPLA group, 29 out of 31 learners or 93.5% had very low problem-solving skills, while 2 or 6.5% were classified as low. The group obtained a mean score of 10.77, equivalent to an MPS of 22%, also interpreted as very low problem-solving skills. These results indicate that both groups had minimal competencies in solving mathematical problems and were relatively comparable before the intervention.

Table 2. Level of Students' Problem-Solving Skills

GROUP												
RANGE	Pretest				Posttest				Retention test			
	RPLA		Non-RPLA		RPLA		Non-RPLA		RPLA		Non-RPLA	
	f	%	f	%	f	%	f	%	f	%	f	%
90- 100	1	3.3	0	0	24	80	20	64.5	19	63.3	14	45.2
86 – 89	2	6.7	0	0	2	6.7	3	9.7	2	6.7	3	9.7
80 - 85	1	3.3	0	0	4	13.3	4	12.9	4	13.3	6	19.4
75 – 79	0	0	2	6.5	0	0	2	6.5	4	13.3	3	9.7
75-below	26	86.7	29	93.5	0	0	2	6.5	1	3.3	2	6.5
MEAN	12.07		10.77		43.17		40		39.9		38.67	
MPS	24%		22%		86%		80%		80%		77%	
VLPS			VLPS		HPS		MPS		MPS		LPS	

Range	Descriptive Rating	Qualitative Interpretation
90 – 100	Exemplary	Very High Problem-Solving Skills (VHPS)
85 – 89	Above Average	High Problem-Solving Skills (HPS)
80 – 84	Average	Moderate Problem-Solving Skills (MPS)
75 – 79	Below Average	Low Problem-Solving Skills (LPS)
74 below	Deficient	Very Low Problem-Solving Skills (VLPS)

After the intervention, both groups showed notable improvement in their post-test results. The RPLA group obtained a mean score of 43.17 (MPS = 86%), interpreted as high problem-solving skills. In terms of performance distribution, 24 learners (80%) achieved very high problem-solving skills, 2 (6.7%) attained high, and 4 (13.3%) demonstrated moderate performance. In contrast, the non-RPLA group obtained a mean score of 40 (MPS = 80%), interpreted as moderate problem-solving skills, with 20 learners (64.5%) classified as very high, 3 (9.7%) high, 4 (12.9%) moderate, 2 (6.5%) low, and 2 (6.5%) very low. Overall, although both groups exhibited gains following instruction, the RPLA group demonstrated higher overall performance and a more favorable distribution of learners across higher proficiency levels, indicating better development of problem-solving skills compared to the non-RPLA group.

The retention test results indicated a slight decline in performance for both groups; however, the RPLA group consistently maintained higher levels of problem-solving skills compared to the non-RPLA group. In the RPLA group, 19 learners (63.3%) remained at a very high level, 2 (6.7%) at high, 4 (13.3%) at average, 4 (13.3%) at low, and 1 (3.3%) at very low. The group obtained a mean score of 39.9 (MPS = 80%), interpreted as moderate problem-solving skills. In comparison, the non-RPLA group obtained a mean score of 38.67 (MPS = 77%), also interpreted as low problem-solving skills, with 14 learners (45.2%) at a very high level, 3 (9.7%) high, 6 (19.4%) moderate, 3 (9.7%) low, and 2 (6.5%) very low. Overall, although both groups experienced a decline from post-test to retention test, the RPLA group demonstrated more stable performance and a more favorable distribution across higher proficiency levels, suggesting better sustained development of problem-solving skills over time.

These findings are supported by Fuchs et al. (2016), who emphasized that structured practice with feedback enhances procedural fluency and accuracy in problem-solving. Similarly, Seethaler et al. (2019) and Gersten et al. (2015) highlighted that systematic instruction and guided learning improve computational accuracy, reduce errors, and strengthen mathematical reasoning. Van de Walle et al. (2019) further noted that problem-solving performance improves when procedural practice is meaningfully integrated with conceptual understanding. In addition, Powell et al. (2017) and Shin et al. (2024) underscored that repeated practice contributes to long-term retention of mathematical skills, while Carriaga-Baril and Abapo (2025) emphasized that targeted instructional interventions enhance efficiency and sustained learning, helping explain the more stable performance observed in the RPLA group.

Table 3 presents the analysis of covariance (ANCOVA) on students' mathematical fluency using pre-test scores as a covariate. The RPLA group obtained a post-test mean score of 67.93 (SD = 6.37), while the non-RPLA group obtained a mean score of 60.61 (SD = 6.87). Although the RPLA group showed a higher mean, the difference between groups was not statistically significant, as indicated by an F-value of 0.016 and a p-value of 0.899 ($p > 0.05$). This suggests that, after controlling for prior ability, the instructional approach did not significantly influence students' mathematical fluency. In contrast, the covariate (pre-test scores) showed a highly significant effect, with an F-value of 454.495 and a p-value of 0.000 ($p < 0.001$), indicating that prior mathematical fluency strongly predicted post-test performance. The partial eta squared values further confirm this pattern, with the instructional method showing no effect ($\eta^2 = .000$), while prior knowledge accounted for a substantial proportion of variance ($\eta^2 = .899$), or 89.9%.

These results imply that students' initial mathematical fluency was the dominant predictor of post-test outcomes, regardless of group assignment. While the RPLA group demonstrated slightly higher mean performance, this difference was not statistically meaningful, indicating that the Reflective Practice Learning Approach did not significantly improve mathematical fluency when adjusted for prior knowledge. Overall, the findings suggest that both groups benefited similarly from instruction, with learners' prior competencies playing a more decisive role in determining achievement outcomes.

Table 3. Comparison of Students' Mathematical Fluency in Mathematics of the Post-Tests Scores

GROUP	N	MEAN	SD
RPLA	30	67.93	6.37

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Non-RPLA	31	60.61	6.87
TOTAL	61	64.21	7.54

SOURCE	SS	df	MS	F-Value	Sig.	Partial Eta Squared
Group	.081	1	.081	.016	.899	.000
Covariate	2262.268	1	2262.268	454.495	.000	.899
Error	283.720	57	4.978			
Total	254935.000	61				

Note: **-significant at 0.05 level

^{ns} -not significant at 0.05 level

The findings are supported by Geary (2017) and Raghubar et al. (2015), who emphasized that prior cognitive ability and working memory significantly influence mathematical performance, explaining the strong effect of pre-test scores. Van de Walle et al. (2019) further noted that mathematical fluency develops gradually through sustained practice and repeated exposure rather than short-term interventions, which may explain the lack of significant difference between groups. In addition, Fuchs et al. (2016) and Schneider et al. (2017) stressed that fluency requires long-term, structured practice that builds accuracy, speed, and automaticity. These studies collectively support the finding that while instructional strategies like RPLA may enhance learning experiences, students' prior knowledge remains the dominant factor influencing mathematical fluency outcomes.

Table. 4. Comparison of Students' Mathematical Fluency in Mathematics of the Retention-Tests Scores

GROUP	N	MEAN	SD
RPLA	30	70.33	5.19
Non-RPLA	31	61.51	7.50
TOTAL	61	65.85	7.81

SOURCE	SS	df	MS	F-Value	Sig.	Partial Eta Squared
Group	29.863	1	29.863	6.668	.012**	.105
Covariate	2071.912	1	2071.912	462.655	.000	.890
Error	255.264	57	4.478			
Total	268185.000	61				

Note: **significant at 0.05 level

^{ns} -not significant at 0.05 level

Table 4 presents the analysis of covariance (ANCOVA) of the retention-test results in mathematical fluency between the RPLA and non-RPLA groups, using pre-test scores as the covariate. The analysis revealed a

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statistically significant difference between the two groups, with an F-value of 6.668 and a p-value of 0.012 ($p < 0.05$), indicating that the instructional approach significantly influenced students' retention performance in mathematical fluency. Descriptive statistics further showed that the RPLA group obtained a higher mean score (M = 70.33, SD = 5.19) than the non-RPLA group (M = 61.52, SD = 7.50). These findings suggest that students exposed to the Reflective Practice Learning Approach (RPLA) demonstrated better retention of mathematical fluency skills than those taught using the non-RPLA approach. Moreover, the lower standard deviation of the RPLA group indicates more consistent performance, whereas the higher variability observed in the non-RPLA group reflects less stable retention of skills.

The findings imply that the RPLA strategy positively and significantly enhanced learners' retention of mathematical fluency. The structured reflective processes embedded in RPLA may have helped students consolidate their understanding and strengthen long-term retention of mathematical procedures. The covariate, pre-test scores, also showed a highly significant effect on retention-test performance, with an F-value of 462.655 and a p-value of 0.000 ($p < 0.001$), demonstrating that prior knowledge strongly influenced learners' retention outcomes regardless of group assignment. The effect size for the instructional approach was moderate (partial $\eta^2 = 0.105$), indicating that approximately 10.5% of the variance in retention scores was explained by the teaching method. In contrast, pre-test scores yielded a very large effect size ($\eta^2 = 0.890$), suggesting that nearly 89% of the variance in retention performance was associated with students' prior knowledge.

These findings are consistent with previous studies emphasizing the importance of structured instruction, reflective learning, and repeated practice in strengthening mathematical fluency and long-term retention. Fuchs et al. (2016) and Poncy et al. (2015) highlighted that repeated and structured practice improves procedural efficiency, accuracy, and automaticity, which contribute to stronger retention. Similarly, Schoenfeld (2016), Rittle-Johnson et al. (2017), and Foster (2018) explained that reflective and conceptually oriented instruction promotes deeper cognitive processing and more durable learning outcomes. Van de Walle et al. (2019) further noted that mathematical fluency develops through meaningful engagement that integrates conceptual understanding with procedural knowledge. Moreover, the strong influence of pre-test scores aligns with the findings of Geary (2017) and Raghubar et al. (2015), who emphasized the critical roles of prior knowledge and working memory in mathematical performance. Studies by McMullen et al. (2018) and Shin et al. (2024) also demonstrated that sustained practice, feedback, and structured interventions contribute to improved long-term retention, further supporting the effectiveness of RPLA in enhancing students' mathematical fluency over time.

Table. 5. Comparison of Students' Problem Solving in Mathematics of the Posttest Scores

GROUP	N	MEAN	SD
RPLA	30	43.17	5.44
Non-RPLA	31	40.00	8.31
TOTAL	61	41.56	7.17

SOURCE	SS	Df	MS	F-Value	Sig.	Partial Eta Squared
Group	567.706	1	567.706	23.733	.000**	.294
Covariate	1564.586	1	1564.586	65.408	.000	.534
Error	1363.463	57	23.920			
Total	108429.000	61				

Note: **-significant at 0.05 level

ns -not significant at 0.05 level

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Table 5 presents the analysis of covariance (ANCOVA) of students' problem-solving skills, using pre-test scores as a covariate to control for differences in prior knowledge and other related predictive factors. The results showed that students exposed to the Reflective Practice Learning Approach (RPLA) obtained a higher mean score (M = 43.17, SD = 5.44) than those in the non-RPLA group (M = 40.00, SD = 8.31). The ANCOVA results revealed a highly significant difference between the two groups, with an F-value of 23.733 and a p-value of 0.000 ($p < 0.001$), indicating that the instructional approach significantly influenced students' mathematical problem-solving performance. These findings suggest that learners exposed to the RPLA demonstrated stronger problem-solving skills compared to those taught using the non-RPLA approach.

In addition, the covariate showed a significant effect on students' performance, with an F-value of 65.408 and a p-value of 0.000 ($p < 0.001$). This indicates that prior knowledge significantly contributed to students' ability to solve mathematical problems, regardless of group assignment. Students with higher pre-test scores generally achieved better post-test performance, highlighting the important role of foundational mathematical understanding in problem-solving development. The lower standard deviation observed in the RPLA group also suggests more consistent performance among learners, whereas the larger variability in the non-RPLA group indicates less uniform achievement in problem-solving skills.

The findings suggest that the Reflective Practice Learning Approach (RPLA) significantly enhanced students' mathematical problem-solving skills. The structured reflective activities integrated into the approach may have enabled learners to examine their reasoning processes, identify misconceptions, evaluate solution strategies, and reconstruct mathematical understanding more effectively. The effect size for the instructional approach, as measured by partial eta squared, was 0.294, indicating that approximately 29.4% of the variance in post-test problem-solving scores was explained by the teaching method, representing a large effect. In addition, pre-test scores yielded an effect size of 0.534, suggesting that about 53.4% of the variance in post-test performance was associated with students' prior knowledge, highlighting the substantial influence of baseline mathematical abilities on problem-solving performance. Overall, the results indicate that both the instructional strategy and prior knowledge significantly contributed to the development of students' problem-solving skills, with RPLA demonstrating a meaningful and substantial impact on learning outcomes.

These findings are supported by De Leon-Pineda and Prudent (2022), who explained that reflective learning activities improve students' mathematical problem-solving by helping them analyze their thinking, identify errors, and reconstruct correct mathematical ideas. Saromines and Buan (2025) further emphasized that reflective thinking enhances reasoning skills and flexibility in solving non-routine problems, while Villanueva (2022) noted that guided reflection strengthens conceptual understanding and procedural accuracy. Ryan (2015), Liljedahl et al. (2016), and Santos-Trigo (2024) also highlighted that reflective practice develops higher-order thinking skills and encourages learners to evaluate and refine their problem-solving strategies. In addition, Ermac and Tan (2023), Bayarcal and Tan (2023), Liu et al. (2020), and Sánchez et al. (2021) stressed that structured, collaborative, and interactive learning environments improve learners' reasoning, critical thinking, and mathematical understanding. Moreover, Diago and Dillo (2022), Abelilla (2024), Viterbori et al. (2017), and Assencio et al. (2015) confirmed that strong foundational knowledge and prior mathematical competence are essential predictors of successful problem-solving performance, supporting the strong influence of pre-test scores observed in this study.

Table 6 shows the comparison of students' retention-test scores in problem-solving skills between the Reflective Practice Learning Approach (RPLA) and non-RPLA groups, which revealed a slight but notable difference in favor of the RPLA group. The RPLA group obtained a higher mean score (M = 39.90, SD = 8.41) compared to the non-RPLA group (M = 38.68, SD = 8.47), suggesting that students exposed to the RPLA strategy demonstrated better retention of problem-solving skills in Mathematics. The computed F-value for the group factor was 10.965 with a p-value of 0.002, indicating a statistically significant difference between the two groups at the 0.05 level of significance. This means that the null hypothesis is rejected, implying that the RPLA strategy had a meaningful effect on students' retention of mathematical problem-solving skills. In addition, the pre-test scores also showed a statistically significant effect on retention performance, with an F-value of 44.290 and a p-value of 0.000, indicating that students' initial problem-solving abilities strongly influenced their retention-test scores.

Table 6. Comparison of Students' Problem Solving in Mathematics of the Retention-Tests Scores

GROUP	N	MEAN	SD
RPLA	30	39.90	8.41
Non-RPLA	31	38.68	8.47
TOTAL	61	39.28	8.39

SOURCE	SS	df	MS	F-Value	Sig.	Partial Eta Squared
Group	455.044	1	455.044	10.965	.002**	.161
Covariate	1837.992	1	1837.992	44.290	.000	.437
Error	2365.440	57	41.499			
Total	98338.000	61				

Note: **-significant at 0.05 level

^{ns} -not significant at 0.05 level

The findings further revealed that the teaching method explained approximately 16.1% of the variance in students' retention-test problem-solving scores, as indicated by the partial eta squared value of 0.161, which represents a moderate effect. This suggests that the Reflective Practice Learning Approach (RPLA) had a noticeable contribution to improving and sustaining students' mathematical problem-solving skills over time. On the other hand, the pre-test scores yielded a partial eta squared value of 0.437, meaning that about 43.7% of the variance in retention-test scores can be attributed to students' prior knowledge and baseline problem-solving ability. These results imply that although prior knowledge remained a strong predictor of retention performance, exposure to the RPLA strategy significantly strengthened students' ability to retain and apply problem-solving skills even after instruction had ended.

These findings are supported by De Leon-Pineda and Prudent (2022), Saromines and Buan (2025), and Villanueva (2022), who emphasized that reflective learning enhances retention by enabling learners to revisit, analyze, and reconstruct their mathematical thinking processes. Similarly, Ryan (2015), Schoenfeld (2016), and Zimmerman (2018) explained that reflective and metacognitive practices strengthen higher-order thinking, self-monitoring, and self-regulated learning, which are essential for sustaining mathematical problem-solving skills. In addition, studies by Ermac and Tan (2023), Bayarcal and Tan (2023), Liu et al. (2020), Sánchez et al. (2021), and Dinglasan et al. (2023) highlighted that structured, collaborative, and meaningful learning environment contribute to improved long-term retention and problem-solving performance. Furthermore, Diago and Dillo (2022), Abelilla (2024), Viterbori et al. (2017), and Assencio et al. (2015) underscored the critical role of strong foundational knowledge in supporting students' retention and success in mathematical problem-solving tasks. Collectively, these studies reinforce the effectiveness of the Reflective Practice Learning Approach in enhancing and sustaining students' problem-solving skills in Mathematics over time.

CONCLUSION

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

The students exposed to the Reflective Practice Learning Approach (RPLA) and those exposed to the non-RPLA approach differed in their level of mathematical fluency across the three assessments. In the pre-test, the RPLA group manifested Low Mathematical Fluency, while the non-RPLA group manifested Very Low Mathematical

Fluency. In the post-test, both groups improved and reached Average Mathematical Fluency, although the RPLA group obtained a higher mean percentage score. In the retention test, the RPLA group further improved to High Mathematical Fluency, whereas the non-RPLA group remained at Average Mathematical Fluency. These findings show that both groups improved, but the RPLA group demonstrated better and more sustained mathematical fluency.

In terms of problem-solving skills, both groups started at a Very Low Problem-Solving Skills level in the pre-test. After the intervention, the RPLA group improved to High Problem-Solving Skills in the post-test, while the non-RPLA group improved to Moderate Problem-Solving Skills. In the retention test, the RPLA group was classified under Moderate Problem-Solving Skills, while the non-RPLA group was classified under Low Problem-Solving Skills. Despite this difference in classification, the RPLA group still obtained a higher mean score than the non-RPLA group. This indicates that the intervention was effective for both groups, but RPLA produced better immediate and sustained gains in students' problem-solving skills in Mathematics.

As to the significant difference in mathematical fluency, the study found no significant difference between the RPLA and non-RPLA groups in the post-test when the pre-test was used as a covariate. However, a significant difference was found in the retention test, where the RPLA group performed significantly better than the non-RPLA group. This means that although the immediate effect of RPLA on mathematical fluency was not statistically established in the post-test, its effect became evident over time, particularly in sustaining students' mathematical fluency.

With respect to problem-solving skills, the study revealed a significant difference between the RPLA and non-RPLA groups in both the post-test and retention test, even when the pre-test was used as a covariate. The RPLA group consistently obtained higher mean scores than the non-RPLA group. Therefore, it can be concluded that the Reflective Practice Learning Approach was more effective than the non-RPLA approach in improving students' problem-solving skills and in helping them retain these skills over time. Overall, the findings establish that RPLA is a more effective instructional strategy in enhancing both mathematical fluency and problem-solving skills, particularly in terms of retention and sustained learning.

RECOMMENDATIONS

Based on the conclusions drawn from the study, the following recommendations are proposed:

The Reflective Practice Learning Approach (RPLA) has shown promising effects on students' mathematical fluency in Mathematics. Educators may integrate it into regular classroom instruction to maximize its benefits, especially in helping students improve and sustain their fluency over time. Since the findings revealed that the RPLA group performed better than the non-RPLA group, particularly in the retention test, teachers may reinforce the strategy through reflective questioning, guided feedback, self-assessment, and follow-up practice activities. Regular formative assessments may also be conducted to monitor students' progress and adjust the strategy as needed. Hence, RPLA should be strengthened with additional retention activities to help students sustain their mathematical fluency.

The teachers may use the Reflective Practice Learning Approach (RPLA) in teaching Mathematics, as it has been shown to help students improve their problem-solving skills more effectively than the non-RPLA approach. Through a structured reflective process that encourages students to analyze their work, recognize errors, and improve their strategies, RPLA promotes active engagement, critical thinking, and independent learning. By incorporating this strategy into their lessons, teachers can help students become more confident and skillful in solving mathematical problems, ultimately strengthening their overall mathematical performance.

The study found no significant difference in mathematical fluency between the RPLA and non-RPLA groups in the posttest, but a significant difference was observed in the retention test. This suggests that RPLA may not immediately produce a statistically significant effect on fluency, but its impact becomes more evident over time. Therefore, it is recommended that educators continue to explore RPLA as a teaching strategy for improving students' mathematical fluency without expecting instant results alone. At the same time, additional reinforcement activities, practice opportunities, and retention tasks may be needed to further strengthen students' fluency alongside classroom instruction.

Moreover, since the findings showed significant differences in the posttest and retention test scores of problem-solving skills in favor of the RPLA group, it is recommended that teachers and school administrators strengthen the implementation of the Reflective Practice Learning Approach (RPLA) in Mathematics classrooms. Teachers should be provided with regular training and workshops focused on effective strategies for applying reflective practices in problem-solving activities. Instructional materials such as reflection journals, activity sheets, and guided questioning tools should also be developed and made available to support the implementation of RPLA. School administrators are encouraged to provide continuous supervision and mentoring to ensure that teachers properly apply the approach in their classes. Collaborative activities such as learning action cells or professional learning communities may also be conducted to share best practices in using RPLA. In addition, teachers should consistently integrate reflection-based tasks in daily Mathematics lessons to strengthen students' analytical thinking. These efforts will help ensure that students are actively engaged in meaningful learning experiences that enhance their problem-solving abilities. Ultimately, the sustained use of RPLA is expected to further improve and maintain students' performance in Mathematics.

For future researchers, it is recommended to examine other factors that may influence students' mathematical fluency and problem-solving skills, as these may help explain and improve students' performance in Mathematics. A study on the Reflective Practice Learning Approach (RPLA) may further explore its effectiveness across different grade levels, mathematics topics, and longer periods of implementation. Future research could also investigate the long-term effects of RPLA on retention and sustained learning. Additionally, further studies may examine how student voice, reflections, and feedback during the RPLA process contribute to improved learning outcomes. Capturing students' lived experiences can offer richer insights into how and why RPLA works and how it can be continuously refined for greater impact. Comparative studies with other instructional approaches may also provide deeper insights into the most effective strategies for improving students' mathematical fluency and problem-solving skills in Mathematics.

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