INTERNATIONAL JOURNAL OF RESEARCH AND INNOVATION IN SOCIAL SCIENCE (IJRISS)
ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume X Issue VI June 2026

Cognitive, Affective and Learning Mechanism (CALM) Framework in Mathematics Enhancing Problem Solving-Skills among Students

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DOI: https://doi.org/10.47772/IJRISS.2026.100600037

Received: 14 May 2026; Accepted: 19 May 2026; Published: 16 June 2026

ABSTRACT

This study addressed the persistent challenge of mathematics problem-solving among Senior High School students who exhibited low performance, high math anxiety, and reliance on rote memorization. Recognizing the gap in existing research that often separated cognitive, affective, and learning processes, this study developed and validated the CALM Framework, an integrated instructional model combining Cognitive, Affective, and Learning Mechanisms to enhance students' problem-solving skills in mathematics. Grounded in established theories such as Bloom's Taxonomy, Polya's problem-solving model, Krathwohl's affective domain, and Flavell's metacognitive theory, the framework targeted mental processes, emotional factors like motivation and confidence, and metacognitive strategies including reflection and self-regulation. Using a quasi-experimental design, the study compared an experimental group taught with the CALM Framework against a control group receiving traditional instruction. Findings revealed that the CALM Framework was highly accepted by experts and significantly improved students' problem-solving abilities. The study recommended wider adoption of the CALM Framework, as the results of the Analysis of Covariance (ANCOVA) revealed a statistically significant effect of the intervention on students' mathematical problem-solving skills, and the Pearson r correlation analysis showed a significant relationship between students' problem-solving performance and their impressions of the framework. The integration of cognitive, affective, and learning mechanisms allowed the framework to effectively respond to the learning challenges faced by Filipino students.

Keywords: CALM Framework, Cognitive, Affective, Learning Mechanism, Problem Solving Skills.

INTRODUCTION

Mathematics problem-solving is a global challenge, with many students struggling to apply concepts to real-life situations. International assessments, such as PISA, consistently reveal weaknesses in critical and analytical thinking, showing that a significant number of learners fall below the proficiency level needed for active participation in society (OECD, 2023).

In the Philippines, this issue is more pronounced. PISA 2022 reported a mathematics score of 278, far below the OECD average of 472, with only 16 percent of Filipino students reaching Level 2 proficiency (Rappler, 2023). High levels of math anxiety further hinder students' confidence and ability to engage in problem-solving tasks (BusinessWorld, 2024).

Students often rely on memorization, struggle with word problems, and experience anxiety that prevents higher-order thinking. While existing studies have examined cognitive or affective factors separately, few have explored their dynamic interplay in classroom settings (Tidalgo, Lodao, & Padillo, 2021).

This study addresses that gap by introducing a learning framework that integrates cognitive, affective, and learning processes. The framework aims to enhance problem-solving skills, reduce math anxiety, and strengthen confidence, offering both practical solutions for the school and theoretical contributions to mathematics education.

INSTRUCTIONAL FRAMEWORKS IN MATHEMATICS

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume X Issue VI June 2026

Instructional framework provides coherence between content, pedagogy, and assessment while promoting deeper conceptual understanding and problem-solving. Influential models such as the NCTM Standards, Common Core, Singapore Math, and approaches like Backward Design, Spiral Curriculum, and Inquiry-Based Learning are grounded in theories of constructivism, socio-cultural learning, and metacognition. Despite these, global assessments like PISA 2022 reveal persistent struggles, with Filipino students ranking among the lowest due to math anxiety and weak metacognitive strategies. To address diverse needs, frameworks such as Bloom's Taxonomy, differentiated instruction, and Universal Design for Learning (UDL) emphasize equity, accessibility, and holistic learning. The "Practicing Connections" framework further strengthens mathematical expertise by linking concepts, representations, and real-world contexts. Together, these frameworks form a comprehensive model that fosters coherence, inclusivity, and transferable knowledge, though effective implementation requires teacher preparedness and contextual adaptation.

Students' Problem-Solving Skills in Mathematics

Problem solving in the 21st century is a vital skill shaped by globalization, technology, and complex social issues. It goes beyond cognitive ability, requiring critical thinking, creativity, teamwork, and metacognition to bridge theory with real-life application. Research shows many students struggle due to limited authentic practice and traditional teaching methods, but approaches like problem-based learning, contextualized instruction, and Polya's four-step model foster deeper reasoning and confidence. In mathematics, success depends not only on computation but also on reflective strategies, heuristics, and creative problem-solving models. Effective assessment, especially open-ended tasks, further enhances flexibility and understanding. In the Philippine context, strong computational foundations combined with contextualized and metacognitive instruction are essential for building resilience, adaptability, and critical thinking—key competencies for thriving in the modern world.

Modern mathematics education demands a comprehensive, student-centered approach that integrates teacher expertise, technological innovation, and emotional engagement to improve learning outcomes. Key studies emphasize that effective instruction requires a shift toward learner-focused strategies, utilizing tools like augmented reality and collaborative professional development to foster joy and understanding.

CALM Framework

The CALM Framework was an integrated instructional model designed to enhance mathematical problem-solving skills by simultaneously addressing three interconnected domains: Cognitive, Affective, and Learning Mechanisms. These components had to integrate in every lesson in Mathematics.

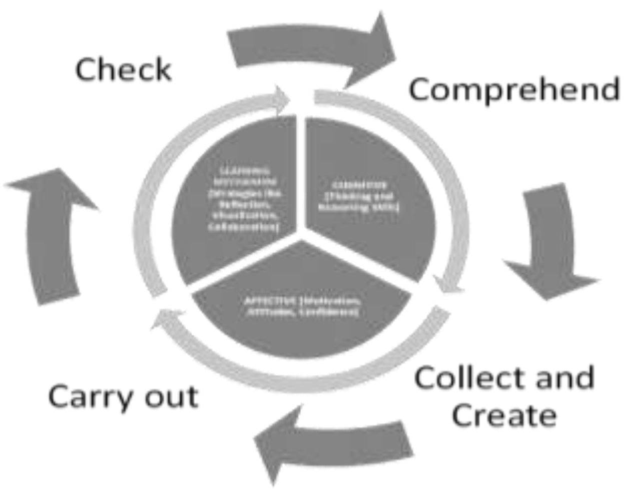

Figure 1. The Cognitive, Affective, and Learning Mechanisms (CALM) Framework

The diagram above illustrates the interconnection and integration of cognitive processes (understanding, reasoning, conceptual clarity), affective factors (motivation, confidence, attitudes), and learning mechanisms (metacognition, reflection, independent learning, and learning strategies) as the foundational pillars of the CALM Framework designed to foster holistic mathematical problem-solving skills.

The cognitive focused on mental processes such as understanding, reasoning, and conceptual clarity in the lessons. The affective focused on emotional climate such as motivation, confidence, and attitudes toward learning, while the learning mechanism focused on metacognition, reflection, independent learning, and learning strategies.

In essence, the CALM framework provided a coherent theoretical approach that integrated cognitive, affective, and learning mechanisms. By drawing upon established theories from Bloom, Polya, Krathwohl, and Flavell, the framework addressed the multifaceted nature of mathematical problem-solving. It offered a holistic view that acknowledged the interdependent relationship between a student's thinking skills, emotional state, and strategic learning approaches. This integrated framework was designed to enhance students' overall mathematical competence by fostering a dynamic and supportive learning environment.

Compared to Bloom’s Taxonomy, which primarily concentrates on hierarchical cognitive development, the CALM Framework extends beyond cognition by incorporating emotional and metacognitive dimensions essential for sustained mathematical engagement. Similarly, while Polya’s Problem-Solving Model provides a structured procedural approach to solving mathematical problems, CALM integrates emotional readiness and reflective learning processes that influence students’ persistence and strategic thinking during problem solving. Furthermore, compared with Flavell’s Metacognitive Theory, which centers mainly on self-monitoring and regulation, the CALM Framework offers a more comprehensive instructional model by explicitly combining cognitive competence, affective support, and learning strategies within a unified pedagogical structure. Anchored on the theories of Bloom, Polya, Krathwohl, and Flavell, the CALM Framework therefore provides a holistic and learner-centered approach that addresses the multifaceted nature of mathematical problem solving and promotes deeper mathematical competence through a supportive and reflective learning environment.

Hence, this study aimed to focus on developing, validating, and determining the effectiveness of the Cognitive, Affective, and Learning Mechanisms (CALM) Framework relative to the problem-solving skills in mathematics of Senior High School students.

METHODOLOGY

This study employed a mixed methodological approach integrating Research and Development (R&D) and quasi-experimental research designs to develop and evaluate the effectiveness of the Cognitive, Affective, and Learning Mechanisms (CALM) Framework in enhancing mathematical problem-solving skills among Senior High School students. The R&D component guided the systematic development, validation, refinement, and implementation of the CALM Framework as an instructional intervention grounded in cognitive, affective, and metacognitive learning theories. Concurrently, a quasi-experimental pretest-posttest control group design was utilized to determine the framework’s effectiveness. Two comparable Grade 11 HUMSS classes were assigned as experimental and control groups. The experimental group received CALM-based instruction, whereas the control group underwent traditional instruction. Pretest and posttest assessments were administered to measure changes in students’ mathematical problem-solving skills following the intervention.

Participants

The study was conducted at Lutayan National High School during the School Year 2025–2026. The participants consisted of two Grade 11 Humanities and Social Sciences (HUMSS) sections comprising 72 students, with 36 students assigned to the experimental group and 36 to the control group. Participants were selected using purposive sampling based on documented low mathematics performance reflected in their recent academic records and first-quarter grades. The selection of low-performing students aligned with the study’s objective of developing targeted instructional interventions to improve mathematical problem-solving competencies. In addition, selected mathematics teachers and subject experts participated in the validation and evaluation phases of the CALM Framework and research instruments.

Instrumentation

The study utilized a researcher-developed instructional framework and assessment instruments validated through expert review and pilot testing procedures. The CALM Framework served as the principal instructional model, integrating cognitive, affective, and metacognitive learning mechanisms into mathematics instruction.

To assess mathematical problem-solving skills, a researcher-made pretest and posttest aligned with Department of Education competency standards were administered to both groups. The assessment instrument underwent expert validation, yielding an excellent Scale-Level Content Validity Index (S-CVI/Ave = 0.96). Based on expert recommendations, the instrument was refined into a focused five-item assessment to maximize representativeness and reduce respondent fatigue.

Students' perceptions of the CALM Framework were further measured using a 15-item CALM Framework Evaluation Questionnaire employing a five-point Likert scale. The questionnaire examined cognitive, affective, and learning mechanism dimensions of the intervention. Content validation produced an S-CVI/Ave of 0.94, while reliability testing demonstrated good internal consistency (Cronbach's $\alpha = 0.84$), indicating that the instrument was both valid and reliable for data collection.

Additionally, the CALM Framework itself underwent expert evaluation involving 15 validators, achieving a perfect content validity index (S-CVI/Ave = 1.00), signifying unanimous agreement regarding the framework's relevance and instructional alignment.

Procedure

The development and implementation of the CALM Framework followed the ADDIE instructional design model consisting of Analysis, Design, Development, Implementation, and Evaluation phases.

During the Analysis phase, baseline data were gathered through students' first-quarter mathematics grades and pretest scores to identify deficiencies in cognitive, affective, and metacognitive aspects of mathematical problem-solving. Literature on Bloom's Taxonomy, Pólya's Problem-Solving Model, Krathwohl's Affective Domain Taxonomy, and Flavell's Metacognition Theory informed the conceptual foundation of the framework.

In the Design phase, the CALM Framework was translated into structured lesson guides and problem-solving activities aligned with curriculum standards and learning competencies. Instructional components were systematically mapped to cognitive, affective, and learning mechanism domains to ensure pedagogical coherence.

The Development phase focused on integrating CALM principles into daily instructional materials and lesson plans. Activities emphasizing critical thinking, motivation, metacognitive reflection, scaffolding, and self-regulated learning were embedded within classroom tasks and instructional sequences.

During the Implementation phase, the experimental group underwent a seven-week CALM-based intervention conducted three times weekly, while the control group received traditional mathematics instruction. Instructional sessions incorporated caring classroom openings, reflective activities, metacognitive prompts, and Pólya's four-step problem-solving process to enhance learners' cognitive engagement and emotional readiness.

Finally, the Evaluation phase involved expert validation of the CALM Framework and comparative analysis of pretest and posttest results to determine intervention effectiveness. Students' feedback and perceptions regarding the framework were also collected and analyzed to assess learning experiences and instructional impact. Statistical analyses included descriptive statistics, ANCOVA, and Pearson correlation analysis to evaluate group differences, effectiveness of intervention, and relationships among study variables.

RESULTS AND DISCUSSION

Acceptability of CALM Framework

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume X Issue VI June 2026

As shown in Table 1, the level of acceptability of the developed CALM Framework among experts in terms of content. The table reveals that the experts rated the framework with a section mean of M = 4.71 (SD = 0.44), verbally interpreted as Very High Valid. This indicates that the content of the CALM Framework was perceived as theoretically sound, comprehensive, and aligned with the intended instructional objectives.

Table 1. The level of acceptability of the developed CALM Framework among Experts in terms of Content

Content	Mean	SD	Verbal Interpretation
1. The objectives of the CALM Framework are clear and well-defined.	4.80	0.40	Very High Valid
2. The components of the CALM Framework effectively address the cognitive, affective, and learning needs of students.	4.73	0.44	Very High Valid
3. The CALM Framework addresses both learners' cognitive and emotional needs effectively.	4.60	0.49	Very High Valid
Section Mean	**4.71**	**0.44**	**Very High Valid**

The highest level of agreement was observed in Item 1 regarding the clarity of objectives (M = 4.80, SD = 0.40), while Item 3, which focused on addressing both cognitive and emotional needs, received the lowest relative score (M = 4.60, SD = 0.49). The tight standard deviation across all indicators confirmed a high degree of expert consensus on the framework's internal validity. These findings validated the CALM Framework as a well-defined instructional model, with its primary strength lying in its clear conceptual goals. The slightly lower mean in the holistic integration of cognitive and emotional needs suggested an area where continued refinement could further strengthen the framework's ability to balance diverse learner requirements.

Overall, these perceptions reinforced the content quality of the framework as a stable foundation for broader educational application. These findings aligned with studies emphasizing that strong expert consensus and high content validity indices reflected the theoretical soundness and instructional relevance of educational frameworks and learning models (Montes et al., 2023; Yoon, 2026). Likewise, recent research highlighted that validated instructional frameworks strengthened the alignment between pedagogical goals, learner needs, and educational implementation, thereby increasing the reliability and applicability of instructional interventions in classroom settings (Lee et al., 2025; Astuti & Zabit, 2025).

Table 2 presents the level of acceptability of the developed CALM Framework among experts in terms of relevance. The table shows that the experts rated the framework verbally interpreted as Very High Valid. This indicates that the CALM Framework was perceived as highly relevant, practical, and adaptable for classroom implementation.

Table 2. The level of acceptability of the developed CALM Framework among Experts in terms of Relevance

Relevance	Mean	SD	Verbal Interpretation
1. The components of the CALM Framework are easy for teachers to understand and apply.	4.60	0.49	Very High Valid
2. The CALM Framework is flexible enough to be adapted to different learning contexts.	4.67	0.47	Very High Valid
3. The implementation procedures of the CALM Framework are practical and feasible within classroom settings.	4.67	0.47	Very High Valid

Section Mean	**4.71**	**0.44**	**Very High Valid**

Among the indicators, the highest ratings were observed in the framework's flexibility to adapt to different learning contexts and the practicality and feasibility of its implementation procedures within classroom settings, both obtaining a mean of M = 4.67 (SD = 0.47), interpreted as Very High Valid. Meanwhile, the indicator stating that the components of the CALM Framework were easy for teachers to understand and apply obtained the lowest mean of M = 4.60 (SD = 0.49), although it still fell within the Very High Valid interpretation.

Overall, the findings reinforced the relevance of the CALM Framework as a stable and dependable pedagogical model suitable for competency based educational settings. These results aligned with recent studies emphasizing that instructional frameworks demonstrating adaptability, usability, and contextual responsiveness were more likely to achieve successful implementation and long-term sustainability in educational environments (Kim & Park, 2024; Yustina et al., 2025).

In table 3, experts evaluated the usability of the CALM Framework at an overall mean of M=4.71 (SD=0.44), representing a Very High Valid level of acceptability. The narrow standard deviation across all indicators reflects a robust consensus among experts, confirming the framework's functional effectiveness. These superior usability ratings validate the CALM Framework as a potent tool for student-centered learning, with its particular strength in engagement suggesting it is well-suited for interactive classroom environments. Such high levels of expert validation reinforce the framework's potential to improve learner outcomes while maintaining strict alignment with professional curricular mandates.

Table 3. The level of acceptability of the developed CALM Framework among Experts in terms of Usability

Usability	Mean	SD	Verbal Interpretation
1. The use of the CALM Framework is likely to improve students' problem-solving skills.	4.73	0.44	Very High Valid
2. The framework promotes active student engagement and participation.	4.80	0.40	Very High Valid
3. The CALM Framework aligns well with current curriculum standards and teaching practices.	4.73	0.44	Very High Valid
Section Mean	**4.71**	**0.44**	**Very High Valid**

These findings are supported by previous studies emphasizing the importance of structured and student-centered instructional frameworks in mathematics education. The expert agreement on relevance aligns with the findings of Shongwe (2024) and AlAli (2024), who found that engaging students in real-world and problem-based learning enhances critical thinking and application skills.

Furthermore, Nurin et al. (2024) highlighted that the effectiveness of instructional frameworks depends on their structure and consistency, which ensures better learning outcomes among students. These studies support the present findings, confirming that well-designed frameworks contribute to improved mathematical performance.

Problem Solving Skills among Students

Table 4 presents the mean scores and standard deviations of the students' problem-solving skills during the pre-test and post-test among the control group exposed to traditional instruction and the experimental group exposed to the CALM Framework.

Table 4. Mean Scores and Standard Deviation of Students' Problem-Solving Skills during Pre-test and Posttest

	Control Group n=36		**Experimental Group N=36**	
	Pre-test	**Post-test**	**Pre-test**	**Post-test**
Mean	9.56	60.78	10.78	72.57
SD	4.09	10.25	4.36	9.28

The results revealed that both groups started with relatively low and comparable pre-test mean scores, with the control group obtaining a mean score of 9.56 (SD = 4.09) and the experimental group obtaining a mean score of 10.78 (SD = 4.36). This indicates that the two groups had nearly similar levels of problem-solving skills prior to the intervention. After the implementation of the instructional approaches, both groups showed improvement in their post-test scores. However, the experimental group recorded a higher post-test mean score of 72.57 (SD = 9.28) compared to the control group's mean score of 60.78 (SD = 10.25). This finding suggests that students exposed to the CALM Framework demonstrated greater enhancement in problem-solving skills than those exposed to traditional instruction. Moreover, the lower standard deviation of the experimental group during the post-test implies that students' performances were relatively more consistent compared to the control group.

The findings imply that the CALM Framework may serve as an effective instructional approach in improving students' problem-solving skills. The substantial increase in the post-test mean score of the experimental group indicates that the framework possibly provided students with more meaningful learning experiences, critical thinking opportunities, and structured strategies for solving mathematical problems.

In contrast, while traditional instruction also resulted in improvement, the gains were relatively lower, suggesting that conventional teaching methods may not be as effective in fostering higher-order thinking skills. Hence, integrating innovative and learner-centered approaches such as the CALM Framework in mathematics instruction may contribute to better development of students' analytical and problem-solving abilities.

Table 5 presents the Analysis of Covariance (ANCOVA) for posttest scores while controlling for pretest performance. The results revealed that the pretest covariate was statistically significant ($F = 18.47$, $p < 0.001$), indicating that students' prior knowledge significantly influenced their posttest performance. More importantly, the group variable representing the intervention also yielded a statistically significant effect ($F = 49.17$, $p < 0.001$). This finding indicates that a significant difference existed between the posttest scores of the control and experimental groups even after adjusting for their initial differences in pretest performance. Hence, the variation in posttest scores could not be attributed solely to students' prior knowledge.

Table 5. Summary of ANCOVA for level of post-test problem-solving skills of the two groups when pre-test scores are treated as a covariate

Source of Variation	SS	df	MS	F	P-value	Decision
Covariate (Pretest)	412.56	1	412.56	18.47	<0.001	Significant
Group (Intervention)	1098.34	1	1098.34	49.17	<0.001	Significant
Error	1541.28	69	22.34			
Total	3052.18	71				

Based on the data, it is evident that the experimental group performed significantly better than the traditional group. The dominance of the experimental group suggests that the CALM Framework employed was more effective in enhancing comprehension, retention, and application of knowledge compared to the traditional lecture-based method. The results indicate that students exposed to the experimental strategy were more engaged and able to demonstrate deeper understanding, which validates the effectiveness of CALM framework.

Therefore, the findings strongly support the conclusion that the experimental group outperformed the traditional group, highlighting the need to adopt innovative instructional practices to improve learning outcomes.

These findings were aligned with studies emphasizing the influence of instructional approaches on students' learning outcomes. Hiebert et al. (2003) highlighted that teaching methods promoting conceptual understanding and active engagement led to improved mathematical performance. In the same manner, OECD (2023) reported that students demonstrated higher achievement when exposed to learning environments that encouraged application, reasoning, and critical thinking. Recent studies also revealed that structured and learner centered instructional interventions significantly improved students' mathematical reasoning, engagement, and academic achievement (Kim & Lee, 2025; Rahman et al., 2024). These studies support the present findings, suggesting that differences in students' academic performance were strongly associated with the quality and nature of the instructional experiences provided during the intervention.

The ANCOVA results not only revealed a statistically significant difference between the experimental and control groups but also indicated a large practical effect of the CALM Framework on students' problem-solving skills. The study reported a large practical effect of the CALM Framework on students' problem-solving skills, with an estimated partial eta squared (η^2) of approximately 0.42, indicating the intervention accounted for a substantial proportion of the variance in post-test scores beyond prior knowledge. According to Cohen (1988), partial eta squared values of 0.01, 0.06, and 0.14 correspond to small, medium, and large effect sizes respectively, so an η^2 of 0.42 represents a very large effect size, demonstrating the strong educational significance of the CALM Framework in improving mathematical problem-solving abilities among Senior High School students.

Impression on CALM Framework among Students

Table 6 presents the level of impressions of students who experienced the CALM Framework on the Cognitive Indicator. Students who experienced the CALM Framework reported a cognitive impact with an overall mean of $M = 4.55$ ($SD = 0.47$), interpreted as Strongly Agree, which signifies the framework's Very High Effectiveness in enhancing mental processes. The highest level of student impression was recorded on Item 5, regarding the framework's ability to help learners bridge previous knowledge with new topics ($M = 4.83$, $SD = 0.37$), while Items 1, 2, and 3 shared the lowest, yet still very high, mean score of $M = 4.47$ ($SD = 0.50$). The exceptionally tight standard deviation on Item 5 reflects a strong student consensus on the framework's role in cognitive scaffolding and knowledge retention.

Table 6. The Level of impressions of students experienced the CALM Framework on Cognitive Indicator

Cognitive	Mean	SD	Description	Interpretation
1. The activities improved my understanding of mathematics concepts.	4.47	0.50	Strongly Agree	The CALM Framework's impact indicates very high effectiveness.
2. The lessons strengthened my logical thinking and reasoning.	4.47	0.50	Strongly Agree	The CALM Framework's impact indicates very high effectiveness.
3. I can solve mathematical problems more effectively using this approach.	4.47	0.50	Strongly Agree	The CALM Framework's impact indicates very high effectiveness.
4. I can apply what I learned to real-life situations.	4.50	0.57	Strongly Agree	The CALM Framework's impact indicates very high effectiveness.
5. The framework helped me remember previous knowledge when learning new topics.	4.83	0.37	Strongly Agree	The CALM Framework's impact indicates very high effectiveness.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume X Issue VI June 2026

Section Mean	**4.55**	**0.47**	Strongly Agree	The CALM Framework's impact indicates very high effectiveness.

These findings validate the CALM Framework as a powerful tool for mathematical comprehension, with its primary strength lying in its ability to facilitate cumulative learning. Overall, these impressions reinforce the framework's cognitive utility, proving that it effectively translates theoretical design into tangible improvements in students' logical reasoning and real world application.

These findings align with recent studies emphasizing that cognitively structured and scaffolded instructional frameworks significantly enhance conceptual understanding, retention, and higher order thinking skills among learners (Rahman et al., 2024; Kim & Lee, 2025). Likewise, contemporary research highlights that learning models integrating cognitive scaffolding and reflective problem solving improve students' mathematical reasoning, transfer of learning, and long term academic performance (Astuti et al., 2024; Yoon & Park, 2025).\

Table 7 presents the level of impressions of students who experienced the CALM Framework on the Affective Indicator. The table reveals that students rated the framework with a section mean of M = 4.47 (SD = 0.49), verbally interpreted as Strongly Agree, indicating that the CALM Framework demonstrated Very High Effectiveness in enhancing students' affective engagement in mathematics learning.

Table 7. The Level of impressions of students experienced the CALM Framework on Affective Indicator

Affective	Mean	SD	Description	Interpretation
6. I feel more motivated to learn mathematics through this framework.	4.53	0.55	Strongly Agree	The CALM Framework's impact indicates very high effectiveness.
7. My confidence in answering mathematics activities increased.	4.50	0.55	Strongly Agree	The CALM Framework's impact indicates very high effectiveness.
8. The lessons helped me enjoy learning mathematics more.	4.61	0.49	Strongly Agree	The CALM Framework's impact indicates very high effectiveness.
9. My attitude toward mathematics became more positive.	4.58	0.49	Strongly Agree	The CALM Framework's impact indicates very high effectiveness.
10. The approach encouraged me to participate actively in the class.	4.64	0.48	Strongly Agree	The CALM Framework's impact indicates very high effectiveness.
Section Mean	**4.47**	**0.49**	**Strongly Agree**	**The CALM Framework's impact indicates very high effectiveness.**

The highest impression was recorded on Item 5, regarding active class participation (M = 4.64, SD = 0.48), while Item 2, focusing on increased confidence, was the lowest relative mean (M = 4.50, SD = 0.55). The narrow standard deviation across indicators suggests a consistent positive emotional response from the learners. These results validate the framework's Very High Effectiveness in fostering a supportive learning environment, particularly in driving student participation and enjoyment. Ultimately, these findings confirm that the CALM Framework successfully improved students' attitudes toward mathematics, providing a strong affective foundation for academic achievement.

The findings were consistent with the study of Tañola and Lomibao (2024), which emphasized that learner centered and engaging instructional approaches significantly improved students' motivation, confidence, and emotional engagement in mathematics learning. Similarly, Bautista and Valtoribio (2024) found that flexible and supportive instructional strategies enhanced students' self-confidence, participation, and positive attitudes toward mathematics. Furthermore, recent studies highlighted that emotionally supportive learning environments positively influenced learners' persistence, classroom participation, and academic motivation, ultimately contributing to improved mathematics achievement (Kim & Park, 2025; Rahman et al., 2024).

Table 8 presents the level of impressions of students who experienced the CALM Framework on the Learning Mechanism Indicator. The table reveals that students rated the framework with a section mean of M = 4.46 (SD = 0.48), verbally interpreted as Strongly Agree, indicating that the CALM Framework demonstrated Very High Effectiveness in fostering students' metacognitive and self regulated learning skills.

Table 8. The Level of impressions of students experienced the CALM Framework on Learning Mechanism Indicator

Learning Mechanism	Mean	SD	Description	Interpretation
11. I became more responsible and independent in learning.	4.58	0.49	Strongly Agree	The CALM Framework's impact indicates very high effectiveness.
12. I became more aware of the strategies I use in solving math problems.	4.47	0.50	Strongly Agree	The CALM Framework's impact indicates very high effectiveness.
13. The approach helped me reflect on my performance and improve it.	4.33	0.47	Strongly Agree	The CALM Framework's impact indicates very high effectiveness.
14. The activities assisted me in developing better study habits.	4.31	0.46	Strongly Agree	The CALM Framework's impact indicates very high effectiveness.
15. I learned how to monitor and assess my own learning progress.	4.61	0.49	Strongly Agree	The CALM Framework's impact indicates very high effectiveness.
Section Mean	**4.46**	**0.48**	**Strongly Agree**	**The CALM Framework's impact indicates very high effectiveness.**

The highest rating was observed in Item 5, regarding the ability to monitor and assess personal learning progress (M = 4.61, SD = 0.49), while Item 4, concerning the development of study habits, received the lowest relative mean (M = 4.31, SD = 0.46). The consistent and tight standard deviation across all indicators reflected a unified student perspective on the framework's procedural benefits. These findings validated the CALM Framework as a robust driver for student autonomy, particularly in self regulation and monitoring. Overall, the data confirmed that the framework successfully equipped learners with the necessary mechanisms to take ownership of their mathematical learning journey.

These findings were consistent with studies emphasizing the importance of integrating cognitive, emotional, and learning processes in instruction. Tidalgo et al. (2021) highlighted that students learned more effectively when cognitive and affective components were addressed together. Similarly, Cambaya and Tan (2022) found that engaging and contextualized learning environments increased students' motivation and participation. In addition, OECD (2023) emphasized that positive learning experiences and active engagement contributed to better understanding and skill development. Recent studies also highlighted that metacognitive and self-regulated learning strategies significantly improved learners' independence, reflective thinking, and academic performance in mathematics (Kim & Lee, 2025; Rahman et al., 2024). These studies supported the present findings, suggesting that students' positive impressions were influenced by meaningful and well-structured learning experiences.

Problem-solving Skills and Impression of CALM Framework?

Table 9 presents the relationship between the experimental group's problem-solving performance and their perception of the CALM Framework. The statistical analysis yielded a Pearson correlation coefficient of 0.48, indicating a moderate positive association. With a p value of 0.003, which was lower than the 0.05 level of significance, the null hypothesis was rejected. This result demonstrates that students' favorable impressions of the framework (Mean = 4.53) were significantly associated with their enhanced post test performance (Mean = 72.56).

Table 9. Pearson r Correlation Results between the level of post-test problem-solving skills and their level of impression of CALM framework

Group	Mean	SD	r-value	Level of Relationship	p-value	Remarks
Post Exp	72.56	9.28	0.48	moderate	0.003	significant
Impression	4.53	0.21				

Consequently, the CALM Framework emerged as a significant contributor to academic success. Students who engaged positively with the instructional design demonstrated stronger abilities in solving complex mathematical problems. The high impression scores suggest that the framework's structured approach enhanced cognitive processes, supporting better retention and application of problem solving strategies during the post test. Overall, the evidence positions the CALM Framework not merely as a passive instructional tool but as an active contributor to students' academic development.

These findings were supported by studies highlighting the relationship between students' learning experiences and academic performance. Tidalgo, Lodao, and Padillo (2021) emphasized that when cognitive and affective aspects of learning were addressed together, students were more likely to develop both positive attitudes and improved academic performance. In the same manner, Tan and Limjap (2018) noted that the use of metacognitive strategies enabled students to better understand problem solving processes, which enhanced both achievement and perception toward learning tasks. Moreover, OECD (2023) reported that students who successfully engaged in problem solving activities tended to develop more positive attitudes toward mathematics. Recent studies also revealed that positive learner perceptions and emotionally supportive instructional environments significantly influenced academic engagement, self regulation, and mathematical achievement (Kim & Park, 2025; Rahman et al., 2024). These studies support the present findings, suggesting that students' performance and impressions were interconnected and influenced by meaningful and well-structured learning experiences.

The CALM Framework uniquely addresses critical challenges prevalent among Filipino Senior High School students, notably math anxiety and dependence on rote memorization. By integrating affective components such as motivation, confidence building, and emotional engagement alongside cognitive strategies and metacognitive learning mechanisms, CALM creates a supportive environment that reduces anxiety and fosters deeper conceptual understanding. This holistic approach contrasts with traditional instruction that often emphasizes memorization, empowering learners to engage more meaningfully with mathematical problems. Given the promising results in the HUMSS track, cross-track replication involving STEM, ABM, and other Senior High School tracks is recommended to verify the framework's adaptability and effectiveness across diverse learner profiles. Such replication would also help tailor interventions to specific educational contexts within the Filipino setting, promoting broader improvements in mathematics education nationwide.

CONCLUSION

The study concluded that the CALM Framework is a valid and effective instructional model for teaching mathematics, as confirmed by expert evaluations of its content, relevance, and usability. Students initially struggled with problem solving and higher-order thinking, but after the intervention, those taught with the CALM Framework showed significantly greater improvement in mathematical problem solving skills compared to traditional methods. The framework also fostered positive perceptions . Importantly, students with more favorable impressions of the framework achieved stronger outcomes, underscoring the link between supportive learning experiences and improved academic achievement.

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ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume X Issue VI June 2026

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