



ADDRESSING LEARNING GAPS IN MATH THROUGH REMEDIAL LEARNING MATERIAL

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ABSTRACT

This study addressed a persistent slump in mathematics performance at Clarence Ty Pimentel National High School, where Grade 9 Mean Percentage Scores stagnated between 60% and 65% over three consecutive years, falling short of the 75% national benchmark. Employing a mixed-methods Developmental-Evaluative research design guided by the ADDIE model, the researcher developed and validated targeted Remedial Learning Materials (RLM). These materials focused on the students' least learned competencies: right triangle trigonometry, the Laws of Sines and Cosines, and solving oblique triangles. The conceptual framework was anchored in Merrill's Principles of Instruction and Vygotsky's Zone of Proximal Development to ensure scaffolded, real-world learning. Field-tested during the 2025–2026 school year, statistical analysis of pre-test and post-test scores revealed a highly significant leap in student performance ($t = 21.34$, $p = 0.0000$), successfully rejecting the null hypothesis. Qualitative feedback from both teachers and students praised the materials for high usability, noting that clear navigation and relatable, contextualized local scenarios made mathematics less intimidating. These findings demonstrate that systematically designed, targeted interventions can effectively transform academic weak spots into areas of mastery. Ultimately, this study underscores the necessity of structured remedial tools for learning recovery and strongly recommends integrating these validated materials into formal school remedial programs to stabilize scores and foster lasting critical thinking skills.

Keywords: *Mathematics Essentials, Remedial Learning Materials, ADDIE Model, Developmental-Evaluative Research, Learning Recovery, Grade 9 Mathematics*

INTRODUCTION

Mathematics is a progressive journey where every new concept builds upon previous insights, making structured instructional support essential for student success. Remedial learning materials (RLMs) serve as an empowering scaffold, reinforcing daily lessons and boosting student confidence by offering accessible entry points into complex topics, meeting learners at their current performance levels, and paving a clear path toward positive academic outcomes. To explore how these supportive tools can effectively elevate achievement and foster lasting mastery, this study contextualizes literature showing that advanced competencies like complex trigonometry remain an uphill battle because abstract concepts are difficult to visualize without real-world anchors (Canonigo, 2025; Tan & Santos, 2024).

Consequently, researchers advocate for the development of targeted remedial materials using systematic frameworks like the ADDIE model to keep interventions tightly aligned with student needs (Ramos, 2023; Stofiana et al., 2026). Empirical data confirms the effectiveness of these materials, proving that when abstract formulas are broken down into everyday scenarios, academic performance and conceptual understanding improve significantly (Cut et al., 2023; Purnomo et al., 2024; Villa, 2025). However, while the development and implementation of structured remediation are widely documented for basic arithmetic, secondary geometry and trigonometry remain heavily ignored in remedial literature, leaving a critical gap that this study directly bridges.

This critical gap is framed by a severe mathematical crisis spanning from global benchmarks down to local public-school classrooms. Internationally, the Program for International Student Assessment (PISA) 2022 results revealed that Filipino students averaged just 355 points in math literacy, well below the Organization for Economic Co-operation and Development (OECD) average of 472 points, effectively placing them five years behind their global peers. This systemic crisis is further highlighted by the Second Congressional Commission on Education (EDCOM II) Report, which reveals that a staggering 1.36% of students possess functional problem-solving skills.

This international and national reality is starkly mirrored at Clarence Ty Pimentel National High School, where Grade 9 Mathematics Mean Percentage Scores (MPS) in abstract trigonometry have flatlined significantly below the 75% national passing benchmark for three consecutive school years. Specifically, the campus recorded an MPS of 62% in SY 2022–2023, 60% in SY 2023–2024, and 65% in SY 2024–2025. This stagnant local performance compels immediate research action, ultimately providing public school educators with a practical, hands-on blueprint to rescue failing grades and make math less intimidating within rural public-school education.

To achieve this, the intervention utilizes a structured framework driven by the ADDIE Model (Analysis, Design, Development, Implementation, and Evaluation) to guide the systematic creation of learning materials. The instructional design is theoretically anchored in Merrill's Principles of Instruction to keep lessons strictly problem-centered, and Vygotsky's Zone of Proximal Development (ZPD) to utilize familiar local scenarios as

natural learning scaffolds. Integrating this comprehensive framework into the classroom provides a direct, empirically validated pathway to stabilize test scores, alleviate math anxiety, and build real-world critical thinking skills where it matters most.

Research Questions

This study aimed to develop, implement, and evaluate remedial learning materials (RLM) for Grade 9 students in mathematics to address their learning gaps and improve their overall academic performance. Specifically, it sought to answer the following research questions:

1. What are the least learned competencies of Grade 9 students in Mathematics Essentials based on their baseline academic performance?
2. Is there a significant difference between the pre-test and post-test scores of the students before and after the implementation of the developed Remedial Learning Materials (RLM)?
3. What is the level of acceptability, usability, and theoretical effectiveness of the developed RLM as evaluated by the respondents in terms of:
 - 3.1 Acceptability: Content, instructional design, logical sequencing, alignment with the MELCs, and pedagogical soundness;
 - 3.2 Usability: Ease of navigation, clarity of instructions, time efficiency, readability and layout, and adequacy of practice and feedback; and
 - 3.3 Merrill's Instructional Effectiveness: Activation, demonstration, application, integration, and problem-centered learning?
4. Is there a significant relationship between the students' perceived usability of the RLM and their academic performance?
5. What enhanced instructional materials can be proposed based on the findings?

METHODOLOGY

Research Design

The study used a mixed-methods Developmental-Evaluative Research Design (DERD) to build and validate the remedial modules (Elveña & Llarenas, 2024). Driven by the ADDIE model, the project moved systematically through five distinct phases: the Analysis phase identified Grade 9 mathematical gaps by reviewing historical performance records; the Design phase mapped out learning objectives, lesson flows, and support scaffolds targeting those specific weak spots; the Development phase involved creating the initial printed RLM drafts and refining them based on expert panel feedback; the Implementation phase deployed the polished modules during ten intensive, 45-minute remedial sessions with a target Grade 9 class; and the Evaluation phase measured the program's success using expert validation scores, student surveys, and pre-test to post-test score comparisons.

Research Locale

The study was conducted at Clarence Ty Pimentel National High School (CTPNHS). This site was selected because internal records showed a persistent, three-year flatline in Grade 9 math scores below the 75% benchmark, offering a relevant environment to test the intervention. Furthermore, CTPNHS provided an ideal, operational ecosystem because its existing remedial frameworks allowed the study to integrate smoothly into school schedules without disrupting daily operations.

Research Respondents and Sampling Technique

Participants were selected using a combination of purposive and criterion sampling to gather data from information-rich sources (Flick, 2022; Merriam & Grenier, 2023). A total sample size of forty-nine (49) respondents participated in the study, which included five (5) Expert Validators who were active Master Teachers or Administrators with at least five years of leadership experience, four (4) Mathematics Teachers who were permanent personnel actively teaching Grade 9 Math with at least three years of experience, and forty (40) Grade 9 Students who were currently enrolled and scored below the 75% proficiency benchmark on the diagnostic pre-test.

Research Instruments

The study utilized two main categories of researcher-made tools consisting of a Mathematics Achievement Test and Evaluation Survey Questionnaires. The achievement test was a 30-item multiple-choice pre-test and post-test measuring fourth-quarter trigonometry competencies including right triangles, the Law of Sines, the Law of Cosines, and oblique triangles. The evaluation surveys utilized a 5-point Likert scale to measure Content Acceptability (accuracy and alignment), Design Usability (navigation, instructions, and layout), and Pedagogical Effectiveness, which was anchored in Merrill's Principles of Instruction covering the activation, demonstration, application, integration, and problem-centered learning indicators. These tools were verified line-by-line by external math experts for content validity, and a pilot test with ten separate, non-sample Grade 9 students confirmed strong internal consistency, yielding Cronbach's alpha values between 0.7907 and 0.9456 for the surveys and securely exceeding the standard 0.70 educational research benchmark for the achievement test.

Data Gathering Procedures

The data collection process followed a structured timeline across three consecutive operational stages: Pre-Implementation, Implementation, and Post-Implementation. During the Pre-Implementation phase, the researcher secured formal administrative clearances from the division superintendent and school principal, administered the 30-item diagnostic pre-test to establish student baselines, and submitted the initial RLM drafts to the expert panel for validation. In the Implementation phase, the researcher conducted a two-week, 10-session remedial program running for 45 minutes per day where students worked through the printed modules following a daily learning

loop of activating prior knowledge, guided concept demonstration using local rural scenarios, and independent problem-solving. During the final Post-Implementation phase, a post-test identical to the pre-test was administered to measure academic growth, user surveys were collected from all respondents, and the resulting raw data was processed to finalize and refine the optimized version of the RLM.

Statistical Treatment of Data

To answer the research questions, the quantitative data was processed using both descriptive and inferential parametric tools. Descriptive statistics, specifically the arithmetic mean and standard deviation (SD), were used to summarize baseline test scores, measure data dispersion, and calculate overall mean Likert ratings along with frequency and percentage distributions. A Paired-Samples t-Test was utilized to compare the pre-test and post-test scores of the same student group to determine if academic gains were statistically significant. A One-Way Analysis of Variance (ANOVA) was applied to check if there were statistically significant differences in how the three distinct respondent groups rated the module's content, design, and usability. Finally, the Pearson Product-Moment Correlation Coefficient (r) was used to measure the strength and direction of the linear relationship between student-perceived usability scores and their actual post-test performance.

Scope and Limitations

This study was strictly limited to the development and evaluation of RLMs focusing on fourth-quarter Grade 9 trigonometry competencies at Clarence Ty Pimentel National High School during the 2025–2026 school year. The participant pool was confined to 5 expert validators, 4 math teachers, and 40 targeted students who fell below the 75% passing threshold. Because of these highly localized characteristics and the short-term, two-week implementation timeline, the findings reflect this specific institutional context and may not automatically generalize urban school systems, different grade levels, or long-term knowledge retention.

RESULTS

Table 1. Comparative Performance Ratings of Students in the Least Learned Mathematics Competencies

Competencies	S.Y. 2022-2023		S.Y. 2023-2024		S.Y. 2024-2025	
	Rating	Remark	Rating	Remark	Rating	Remark
Uses trigonometric functions to solve real-life problems involving right triangles (M9GE-IVe-1)	61.45	Least Learned	56.02	Least Learned	50.67	Least Learned

Illustrates laws of sines and cosines (M9GE-IVf-g-1)	57.89	Least Learned	54.17	Least Learned	50.03	Least Learned
Solves problems involving oblique triangles (M9GE-IVh-j-1)	56.11	Least Learned	52.71	Least Learned	48.09	Least Learned

The longitudinal data in Table 1 reveals a severe, compounding decline in Grade 9 geometric and trigonometric mastery, with scores consistently flatlining well below the national 75% passing benchmark. When isolating individual competencies, using trigonometric functions to solve real-life problems involving right triangles emerged as the students' relative strength across all years, though it steadily dropped from 61.45% to 50.67%. This relative proficiency stems from the structural familiarity of right-angled configurations, which allow learners to easily anchor their calculations around a predictable 90-degree angle and lean on straightforward mnemonic devices like SOH-CAH-TOA.

Conversely, solving problems involving oblique triangles marked the definitive historical low point, bottoming out at 48.09% in S.Y. 2024–2025. Moving away from standard right angles triggered severe cognitive overload for the students, as non-orthogonal systems demand advanced spatial reasoning, complex algebraic manipulations, and the difficult task of selecting and executing the correct mathematical pathway using the Laws of Sines and Cosines. This systemic, multi-year drop historically validates the necessity of the study's framework, reinforcing the assertions of Chandra et al. (2023) and Salazar and Uy (2026) that mathematical performance flatlines into an academic crisis when students are forced into abstract memorization rather than contextualized interventions situated directly within Vygotsky's Zone of Proximal Development (ZPD).

Table 2. Pre-test and Post-test Results of Students Before and After RLM Implementation

Tests	Mean	Standard Deviation
Pre-test	16.2	3.56
Post-test	24.05	2.375

The assessment data presented in Table 2 reveals a major increase in student performance following the intervention, transitioning from a low descriptive baseline to a high level of mastery. Before the deployment of the modules, the diagnostic pre-test recorded a low mean score of 16.20 coupled with high score variance (SD = 3.560). This initial state empirically illustrates the deep-seated conceptual gaps and lack of cognitive anchors students faced when dealing with un-scaffolded trigonometry; without the intervention, learners lacked the procedural frameworks needed to process multi-step formulas. Following the ten-session remedial program, the post-test results rose

significantly to a high mean score of 24.05, while simultaneously compressing the score spread to a narrow SD = 2.375.

The striking upward pivot and tightened score distribution demonstrate that the physical workbooks effectively leveled the classroom playing field. This material successfully replaced abstract equations with real-world school and community settings (e.g., measuring campus flagpoles, calculating shadows, and referencing regional farming or coastal fishing) which were reinforced by active parent involvement centered on the affective domain. By pairing these highly relatable settings with continuous parental encouragement to minimize math anxiety, the intervention nurtured both student confidence and conceptual understanding. This successful recovery confirms the empirical instructional models established by Rafizal et al. (2026), proving that a strong positive correlation exists between systematic physical learning workbooks and student mastery within a heavily scaffolded, active application environment.

Table 3. Test of Significant Difference Between Pre-test and Post-test Results

Sources of Variation	Computed t	P-value	Decision	Conclusion
Pre-test & Post-test	21.34	0.0000	Reject H_0	Highly Significant

The inferential analysis presented in Table 3 indicates a highly significant difference between the pre-test and post-test scores of the students. With a computed t-value of 21.34 and a p-value of 0.0000 (which is well below the standard alpha level of 0.05), the null hypothesis (H_0), which states that there is no significant difference between the two testing periods, is confidently rejected.

The researchers interpret this statistical breakthrough as definitive empirical evidence that the localized Remedial Learning Materials (RLMs) served as the primary catalyst for the students' academic growth. Rather than achieving higher scores through testing familiarity, maturational regression, or random guessing, the systematic design of the intervention targeted the exact cognitive friction points where students previously faltered.

This statistical outcome strongly aligns with the literature on instructional scaffolding. According to Vygotsky's concept of the Zone of Proximal Development (ZPD), underperforming students require directed, external structural anchors to transform latent capacities into independent mathematical execution. This finding is also highly consistent with the empirical research of Merrill (2002) and recent regional assessments by Rafizal et al. (2026), which demonstrate that structured, chunked instructional tools significantly compress achievement variance while shifting the target performance curve upward.

Practically, the results imply that when mathematics remediation moves away from passive memorization and instead relies on concrete, real-world community applications, abstract geometric and trigonometric principles become cognitively accessible to

struggling learners. Without the introduction of this material, student performance would have likely stagnated or sustained its initial highly scattered state, as educators would lack the targeted scaffolding needed to systematically address deep-seated misconceptions in trigonometry.

Table 4. Overall Evaluation Ratings for the Developed RLM

Evaluation Dimension	Teachers Mean	Validators Mean	Students Mean	Grand Mean	Overall Adjectival Interpretation
I. Level of Acceptability	4.930	4.888	4.789	4.868	Highly Acceptable
II. Level of Design & Usability	4.870	4.816	4.643	4.776	Highly Usable
III. Perceived Pedagogical Effectiveness	4.910	—	4.753	4.832	Highly Effective
OVERALL INTERVENTION METRIC	4.903	4.852	4.728	4.825	Highly Commendable

The localized remedial material was subjected to rigorous evaluation across distinct educational cohorts, classroom teachers, expert external validators, and Grade 9 students, to systematically verify its quality. The evaluation was anchored on three essential educational vectors: curriculum acceptability, operational design usability, and perceived pedagogical effectiveness.

The evaluation descriptive profile presented in Table 4 demonstrates an exceptional cross-cohort consensus regarding the structural quality of the material, culminating in an Overall Intervention Metric of 4.825, descriptively interpreted as Highly Commendable.

The Level of Acceptability registered the highest combined rating among the dimensions with a Grand Mean of 4.868 (Highly Acceptable). This high score is anchored on the exceptionally high evaluation provided by classroom teachers (mean = 4.930) and expert validators (mean = 4.888). The researchers interpret this trend as a direct reflection of the material's strict mapping to the Department of Education's Most Essential Learning Competencies (MELCs). By matching the instructional goals precisely to national curriculum requirements, the design minimizes extraneous content, which directly lowers lesson-planning stress for educators while ensuring predictable assessment targets for students. This structural clarity aligns with the curriculum optimization models of Salazar

and Uy (2026), who argue that strict competency alignment prevents instructional drift in remedial settings.

The Level of Design & Usability yielded a Grand Mean of 4.776 (Highly Usable). While remaining exceptionally strong, this dimension recorded the relatively lowest score across cohorts, driven primarily by the student group (mean= 4.643). The researchers attribute the minor drop in student scores to the initial learning curve that struggling public school students face when transitioning from passive handouts to an interactive workbook that demands independent data manipulation and spatial drawing. Conversely, teachers rated this dimension highly (mean = 4.870), noting that the embedded worksheets and clear format streamlined self-paced implementation without creating extra administrative prep work. This design success is consistent with the multimedia work of Besana et al. (2022), which shows that uncluttered layouts and open workspaces lower mathematical visual fatigue and lessen test anxiety.

The Perceived Pedagogical Effectiveness dimension achieved a Grand Mean of 4.832 (Highly Effective). Teachers gave this a near-perfect mean rating of 4.910, confirming that the material successfully moves classroom dynamics away from passive memorization and toward active geometric application. Students also rated this dimension highly (mean} = 4.753), proving that anchoring abstract trigonometry principles within community-situated scenarios, such as local campus landmarks, agricultural shadows, and regional coastal environments create clear mental schemas. This outcome confirms the instructional frameworks of Merrill (2002) and recent local studies by Rafizal et al. (2026), which show that placing abstract mathematical problems within real-world contexts gives struggling learners the exact scaffolding required to successfully transfer knowledge to new application tasks.

The cumulative statistical and qualitative insights established the final, optimized structural blueprint for the enhanced version of the instructional intervention. This final output directly addresses the core limitations of standard Department of Education Learning Activity Sheets (LAS). Traditional materials frequently move too quickly, utilize dense, uniform text blocks, and lack functional workspace, creating secondary cognitive barriers that cause underperforming public-school students to shut down when facing complex word problems.

To remedy this, the enhanced material, engineered through the ADDIE framework, isolates specific Least Learned Competencies and systematically breaks them down using the cyclical mechanics of Merrill's First Principles of Instruction. Long, intimidating blocks of text are discarded in favor of clear, bold formatting and large calculation panels that facilitate hands-on, pencil-and-paper geometric drawing. By embedding step-by-step scaffolding and anchoring abstract trigonometry formulas within highly relatable community-based scenarios, such as measuring local campus flagpoles or calculating agricultural shadows, the enhanced Remedial Learning Material ceases to be a rigid administrative document. Instead, it functions as an interactive, high-response math workbook that serves as a tangible More Knowledgeable Other, materializing a stress-

free and highly effective Zone of Proximal Development designed for genuine academic recovery.

Conclusions

Based on the data and statistical results gathered in this study, the following conclusions are presented to address the specific goals of this research regarding how the developed localized Remedial Learning Material (RLM) in Grade 9 Trigonometry was built, used, and evaluated:

Students often find it challenging to transition from right triangles to oblique triangles. Right-triangle geometry feels manageable because learners can rely on simple trigonometric shortcuts like SOH-CAH-TOA. However, removing the familiar 90° angle creates a learning bottleneck, as students must now navigate complex shapes without their usual reference points. Multi-year score declines show that these learning gaps are widening. Because traditional, passive handouts are no longer effective, students need structured step-by-step tools designed to catch and fix these struggles early on.

The data shows that when you structure math content around local, relatable contexts, students start to recover and close those learning gaps. We saw post-test scores jump, which proves these materials help students finally grasp concepts that used to confuse them. Even better, the gap between the highest and lowest scores shrank, meaning this approach works consistently for everyone, not just the top students. At the end of the day, math remediation works best when we ditch dense walls of text and focus on highly visual, active, step-by-step practice.

This turnaround is a huge win, and it proves that localized Remedial Learning Modules (RLMs) can genuinely fix deep-seated learning gaps in math. The numbers suggest that trading passive, text-heavy pages for an active, hands-on workbook approach lowers the mental walls that cause struggling students to give up. Ultimately, math remediation succeeds when we stop asking kids to memorize abstract rules and instead give them real-world, step-by-step practice to build skills that stick.

The developed remedial material is highly commendable, showing exceptional quality across all educational cohorts. It is curriculum-aligned and strictly adheres to national competencies, which eliminates unnecessary cognitive load for students and minimizes lesson-preparation fatigue for teachers. While transitioning to interactive workbooks creates a minor initial adjustment curve for students, the material's clean layout and real-world scenarios successfully shift classroom dynamics away from rote memorization and toward highly effective, independent geometric problem-solving, as supported by the multi-perspective ratings.

In the end, successfully creating this RLM proves that breaking down complex geometry and trigonometry into localized, self-paced modules directly solves the shortcomings of standard textbooks. With teachers, experts, and students all giving it an enthusiastic thumb-up, the material has proven to be a reliable, practical tool for helping kids catch up. This project shows that when you anchor abstract math in the real world

through a structured, step-by-step format, you can break the cycle of student frustration and create a blueprint for math support that can be used anywhere.

Recommendations

Based on the findings and conclusions of this study, the following recommendations are put forward for consideration:

Learners struggling with geometry and trigonometry might find it helpful to use RLM as a self-paced practice companion. Taking advantage of the extensive practice sections could help build skills and confidence step-by-step, allowing them to comfortably patch up learning gaps before moving on to higher math.

Instructional designers could explore integrating the ADDIE model and Merrill's First Principles of Instruction when building future remedial resources. It may be beneficial to focus heavily on instructional clarity and layout usability, as these specific design elements appear to play a major role in helping students absorb difficult mathematical concepts.

Educators are encouraged to consider trying out the problem-centered, localized approach featured in this RLM during their remedial sessions. By utilizing a module that helps streamline lesson preparation, teachers might find themselves with more available time to offer targeted, one-on-one guidance to struggling learners during traditional trigonometry bottlenecks.

Leadership may want to look into utilizing and integrating the developed RLM within their school's existing remedial or tutorial programs. To help keep these academic gains going, administrators might consider providing practical support, such as available printing resources, dedicated scheduling, or brief orientation sessions, to ensure the module is rolled out smoothly.

It is suggested that the division office look into the possibility of adopting the validated RLM as an optional intervention tool for Grade 9 Mathematics. The Department might consider evaluating how this material could support the ongoing Learning Recovery Plan to help schools meet MELC requirements in a more efficient, localized manner.

Future studies could build upon this research by running a longer evaluation to see if student performance gains hold up over time. Additionally, researchers may want to look into converting this localized RLM into an interactive digital or mobile format to test if technology-based usability offers an even greater boost to student achievement

Compliance with Ethical Standards

To ensure compliance and uphold strict ethical standards, the study was conducted under the direct guidance of DepEd Order No. 16, s. 2017 (Research Management Guidelines), with formal administrative permits secured from the Schools Division Office, Public Schools District Supervisor, and respective School Heads prior to

baseline data extraction and RLM implementation. In strict accordance with the Data Privacy Act of 2012 (R.A. 10173), all participant records, test scores, and evaluative metrics were completely anonymized using alphanumeric codes, and all data was securely stored in password-protected drives accessible exclusively to the researcher. The structural design of the remedial learning material strictly conformed to the Most Essential Learning Competencies (MELCs) mandated by DepEd Order No. 012, s. 2020, guaranteeing that the intervention remained aligned with national curriculum standards without disrupting official instructional time-on-task policies under DepEd Order No. 9, s. 2005.

Ethical participant protections were fully integrated through a dual-layered consent process, obtaining signed Informed Parental Consent Forms for the minor student participants alongside clear Student Assent Forms to ensure their participation was entirely voluntary. Every stakeholder, including classroom teachers, external expert validators, and students, was explicitly informed of their absolute right to withdraw from the evaluation or remediation process at any juncture without incurring any academic penalty, loss of institutional benefits, or negative evaluation. To fulfill the ethical mandate of non-maleficence, the material was carefully structured as a low-stress, heavily scaffolded active application workbook that avoided punitive grading or high-stakes time constraints, actively working to mitigate math anxiety. Finally, absolute academic integrity was maintained through rigorous plagiarism checks, proper citation of foundational models, non-discriminatory purposive sampling of expert validators, and the complete, transparent reporting of all statistical metrics without any data fabrication, falsification, or conflict of interest.

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