

Strategic Intervention Material: A Competency-Based Instructional Tool for Improving Ninth Graders' Mathematical Performance

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Abstract

This study was conducted to determine the effectiveness of Strategic Intervention Material (SIM) as a competency-based instructional tool for improving ninth-grade students' mathematical performance. An explanatory sequential mixed-method approach was employed in this study, involving six groups of Grade 9 students who utilized teacher-made strategic intervention materials. The data were gathered from 132 participants using the pretest and posttest. The quantitative data were analyzed using descriptive and inferential statistics such as mean, percentage, standard deviation, independent t-test, and analysis of variance (ANOVA). While the qualitative data obtained from the interview were analyzed through thematic analysis. Findings showed that there was a significant difference between pretest and posttest scores of each group of ninth graders. The result of the ANOVA revealed that there was no significant difference in the pretest and posttest of the six groups of ninth graders, which implies that SIM has the same effect on students' performance. Students perceived SIM as a valuable material that helps them better understand the lesson and simplify complex topics in math. It was concluded in the study that strategic intervention material helped improve students' mathematical performance and can be a tool to support students who are struggling in mastering the required competencies. The study supports Sustainable Development Goal 4 by promoting inclusive, equitable, and effective mathematics education through targeted instructional support. Its sustainability impact lies in providing teachers and schools with an adaptable intervention resource that can strengthen remediation programs, improve instructional practices, and sustain learners' mastery of mathematical competencies over time.

Keywords: Competency-Based Instructional Tool, Grade 9 Students, Learning Experiences, Mathematical Performance, Mixed-Methods Research, Right Triangles, Strategic Intervention Material (SIM), Trigonometric Concepts

1. Introduction

Mathematical competence has become increasingly important for educational success and workforce preparedness, particularly in the context of technological advancement, automation, and data-driven industries. The World Economic Forum (2020) identified mathematical reasoning, computational thinking, and data analysis among the essential competencies required in the evolving global labor market. However, mathematics education continues to face considerable challenges both globally and nationally, with many students demonstrating inadequate mastery of fundamental mathematical concepts. In the Philippines, concerns regarding mathematics achievement have intensified following consistently poor performance in large-scale assessments. Results from the Southeast Asia Primary Learning Metrics (SEA-PLM) indicated that only a small proportion of Filipino learners achieved the expected standards in mathematics, while the Programme for International Student Assessment (PISA) revealed that Filipino students ranked among the lowest-performing participants, scoring substantially below the OECD average. Likewise, the Department of Education (2019) recognized that many Filipino learners possess inadequate mathematical competencies, emphasizing the need for educational reforms to address persistent learning gaps. In response, the Department of Education introduced the Revised K-10 Curriculum through DepEd Memorandum No. 054, s. 2023 to strengthen foundational literacy and numeracy skills and improve learner preparedness for higher education, employment, and lifelong learning.

Department policies likewise mandate intervention for struggling learners. DepEd Order No. 8, series of 2015 requires that learners who obtain grades below 75 receive remediation and additional instructional support. In response to this directive, Fort Bonifacio High School implemented the electronic Strategic Intervention Material (E-SIM) to provide targeted assistance for learners at risk of failing. The initiative reflects the Department's continuing effort to reduce learning deficiencies through structured intervention programs. Classroom observations further revealed that many Grade 9 students experienced difficulties in understanding mathematical concepts, retaining previously learned lessons, solving mathematical problems independently, and accessing sufficient learning resources. These challenges were reflected in consistently low performance in summative assessments, quarterly examinations, and periodic tests, indicating that many students failed to master the required competencies. Such findings reinforced the need for effective intervention materials capable of addressing least-mastered competencies and improving mathematical achievement.

Strategic Intervention Materials have been identified as effective remediation tools that enable learners to master competencies through structured, interactive, and self-paced learning activities (Dumigsi and Cabrella, 2019). These materials are specifically designed to support independent learning while reinforcing classroom instruction. Previous studies likewise reported that the use of intervention materials contributes to improved mathematical performance and enhanced mastery of competencies (Arpilleda, 2021; Lazo and De Guzman, 2021). The present study focused on Strategic Intervention Materials addressing problems involving right triangles because this competency was identified as one of the least-mastered skills based on previous periodic assessment results. Furthermore, limited evidence was found regarding the effectiveness of SIM implementation within Fort Bonifacio High School. Consequently, the study sought to determine whether competency-based Strategic Intervention Materials could improve the mathematical performance of Grade 9 students while providing evidence that may guide the development of future instructional interventions, innovative teaching strategies, and mathematics support programs.

The literature consistently identifies mathematics as an essential discipline that develops logical reasoning, critical thinking, and problem-solving skills necessary for academic achievement and everyday life (Acharya, 2017; Purbaningrum et al., 2023). Despite its importance, mathematics remains one of the most challenging subjects for many learners because of its abstract concepts, complex problem-solving requirements, and negative learner perceptions. Several studies attribute students' poor achievement to a combination of instructional practices, learner characteristics, classroom environment, and inadequate learning resources (Gafoor and Kurukkan, 2015; Jameel et al., 2016; Langoban, 2020; Iwuanyanwu, 2021). Collectively, these findings emphasize that effective mathematics instruction requires competent teachers, learner-centered pedagogies, supportive learning environments, and sufficient instructional resources. Related literature likewise highlights the persistent decline in students' mathematical performance as reflected in national and international assessments. Filipino learners consistently ranked among the lowest-performing participants in the Programme for International Student Assessment (PISA), International Association for the Evaluation of Educational Achievement (2020), National Achievement Test (NAT), indicating substantial deficiencies in mathematical proficiency and higher-order thinking skills (Dooma et al., 2024; Acido and Caballes, 2024; Lopez, 2022; Magas, 2023; Dicediquin et al., 2023; Layug et al., 2021). These findings collectively suggest that improving mathematics education requires enhanced instructional approaches, differentiated teaching strategies, and targeted interventions that directly address students' learning needs.

The reviewed literature consistently recognizes instructional and intervention materials as effective mechanisms for improving student engagement, conceptual understanding, procedural fluency, confidence, and academic achievement. Well-designed instructional resources provide meaningful learning experiences, increase learner participation, and strengthen retention of mathematical concepts (Cayabas and Sumeg-ang, 2023; Darling-Hammond et al., 2020; Balazo, 2021; Limbago-Bastida & Bastida, 2022; Schunk and DiBenedetto, 2020; OECD, 2021). Conversely, insufficient or inaccessible instructional materials contribute to poor comprehension, reduced engagement, and limited opportunities for applying mathematical knowledge (Cayabas and Sumeg-ang, 2023). Furthermore, intervention materials are particularly valuable for addressing least-mastered competencies by providing structured, targeted, and individualized learning experiences that reinforce both conceptual and procedural understanding (Lazo and De Guzman, 2021; Laña, 2023; Arpilleda, 2021). Among the various intervention approaches, Strategic Intervention Materials (SIMs) have received considerable attention as competency-based instructional tools specifically designed to remediate learning gaps and improve mastery of least-learned competencies. SIMs provide structured learning through interconnected components, including title, guide, activity, assessment, enrichment, and reference cards, enabling learners to engage actively with mathematical concepts while progressing at an appropriate pace (Zabala, 2023; Salviejo, Aranes, and Espinosa, 2014; Arpilleda, 2021). Their implementation is further supported by Department of Education policies promoting systematic remediation and teacher-developed intervention materials to improve students' academic performance (DepEd Memorandum No. 117, s. 2005; DepEd Memorandum No. 225, s. 2009). Additionally, effective SIM development requires alignment with learning competencies, Bloom's Taxonomy, and validated instructional design principles to maximize learning outcomes (Arpilleda, 2021; Hwang and Tu, 2021; National Council of Teachers of Mathematics, 2020; Limbago-Bastida & Bastida, 2022).

Empirical studies consistently demonstrate the effectiveness of Strategic Intervention Materials in improving students' mathematical achievement, conceptual understanding, learning gains, and retention. Research conducted by Balazo (2021), Limbago-Bastida and Bastida (2022), Villar et al. (2022), Salviejo et al. (2014), Paco and Linaugo (2023), Dumigsi and Cabrella (2019), Cagape et al. (2023), Schindler et al. (2017), OECD (2020), Martin et al. (2021), and Arpilleda (2021) consistently reported significant improvements in students' posttest performance following SIM implementation. These studies indicate that structured intervention materials enhance conceptual understanding, increase engagement, strengthen confidence, improve problem-solving abilities, and facilitate mastery of least-learned competencies more effectively than conventional instructional approaches. The synthesis of the reviewed literature reveals several recurring themes. First, mathematics remains indispensable for learners' academic and professional development, yet student achievement continues to be hindered by instructional, learner, and environmental factors. Second, instructional quality and appropriate

learning resources significantly influence mathematical achievement. Third, competency-based intervention materials, particularly Strategic Intervention Materials, provide an effective means of addressing learning deficiencies by promoting active learning, conceptual understanding, and mastery of competencies. Finally, although previous studies consistently support the effectiveness of SIMs, there remains a need for localized investigations examining their impact on specific mathematical competencies and learner populations. These collective insights provide the scholarly foundation for evaluating Strategic Intervention Materials as a competency-based instructional tool for improving the mathematical performance of Grade 9 students at Fort Bonifacio High School.

Mathematics is widely recognized as a fundamental discipline that equips learners with analytical, computational, and problem-solving competencies essential for education, employment, and lifelong learning. Globally, increasing technological innovation, automation, and data-driven industries have heightened the demand for individuals with strong mathematical reasoning and computational skills, as emphasized in the 2020 World Economic Forum report. Despite this growing demand, many education systems continue to experience challenges in developing students' mathematical proficiency, prompting governments and educational institutions to strengthen instructional approaches and intervention programs. At the national level, mathematics education remains one of the most pressing concerns in the Philippine educational system. Results from the Southeast Asia Primary Learning Metrics (SEA-PLM), Programme for International Student Assessment (PISA), International Association for the Evaluation of Educational Achievement (2020), National Achievement Test (NAT) consistently demonstrate that Filipino learners perform below both regional and international standards in mathematics (Dooma et al., 2024; Acido and Caballes, 2024; Lopez, 2022; Magas, 2023; Dicediquin et al., 2023; Layug et al., 2021). These findings underscore persistent deficiencies in mathematical proficiency and highlight the need for educational reforms that strengthen foundational numeracy skills and improve instructional quality. In response, the Department of Education introduced the Revised K–10 Curriculum through DepEd Memorandum No. 054, s. 2023 and reinforced intervention programs through DepEd Order No. 8, series of 2015 to ensure that learners experiencing academic difficulties receive appropriate remediation and instructional support.

Within the local context, Fort Bonifacio High School implemented electronic Strategic Intervention Materials (E-SIM) to provide remediation for students identified as being at risk of failing mathematics. Classroom observations and assessment records revealed that many Grade 9 students experienced difficulty understanding mathematical concepts, retaining previous lessons, solving mathematical problems, and achieving the required competency levels. These challenges were reflected in consistently low scores in summative assessments, quarterly examinations, and periodic tests, where a considerable proportion of learners failed to attain the expected performance standards. The competency involving solving problems related to right triangles was likewise identified as one of the least-mastered learning competencies, emphasizing the necessity for targeted instructional interventions. These local conditions provided the immediate context for evaluating the effectiveness of Strategic Intervention Materials in improving students' mathematical performance.

This study is anchored on Discovery Learning Theory (DLT) proposed by Jerome Bruner (1915) and Meaningful Learning Theory (MLT) proposed by David Paul Ausbel, both of which emphasize active knowledge construction and meaningful understanding. Discovery Learning Theory explains that learning occurs most effectively when students actively construct knowledge through exploration, inquiry, and problem-solving rather than through passive reception of information. The theory distinguishes between open discovery and guided discovery learning, with guided discovery allowing teachers to provide structured support while learners independently develop conceptual understanding (Johnson, 2017). This theoretical perspective aligns with the design of Strategic Intervention Materials, which engage learners in structured activities that encourage exploration, investigation, and independent problem-solving while providing sufficient instructional guidance. Through this approach, learners develop deeper conceptual understanding, strengthen critical thinking, and improve retention of mathematical concepts related to solving problems involving right triangles.

Meaningful Learning Theory complements Discovery Learning Theory by emphasizing that learning becomes meaningful when new knowledge is logically connected to learners' existing cognitive structures. According to Rhalmi (2024), students achieve deeper understanding when they integrate new concepts with prior knowledge through organized and meaningful learning experiences. Strategic Intervention Materials support this process by presenting mathematical concepts in a structured sequence that allows students to relate previously acquired knowledge to new learning tasks. Consequently, learners are able to apply prior mathematical concepts to unfamiliar situations, resulting in improved conceptual understanding, stronger knowledge retention, and enhanced problem-solving ability. The conceptual framework of the study illustrates the systematic process used to evaluate the effectiveness of Strategic Intervention Materials. Students initially completed a pretest to determine their baseline knowledge and competency levels. Following the administration of the pretest, the Strategic Intervention Materials were implemented to facilitate mastery of the targeted mathematical competencies. A posttest was subsequently administered to determine improvements in students' mathematical performance, while interviews were conducted to gather learners' insights and learning experiences regarding the intervention. The comparison of pretest and posttest results, together with qualitative findings, provided a comprehensive

evaluation of the effectiveness of Strategic Intervention Materials as a competency-based instructional tool for improving the mathematical performance of Grade 9 students.

The reviewed literature consistently demonstrates that mathematics remains one of the most challenging academic disciplines and that Strategic Intervention Materials (SIMs) are effective instructional tools for improving learners' mathematical achievement, conceptual understanding, learning gains, and mastery of least-learned competencies (Balazo, 2021; Limbago-Bastida & Bastida, 2022; Villar et al., 2022; Salviejo et al., 2014; Paco and Linaugo, 2023; Dumigsi and Cabrella, 2019; Arpilleda, 2021). However, despite these documented benefits, previous studies have largely focused on different mathematical topics, grade levels, research settings, and instructional contexts. Within Fort Bonifacio High School, classroom observations and assessment results revealed persistent learning difficulties among Grade 9 students, particularly in solving problems involving right triangles, which was identified as one of the least-mastered competencies. The researcher likewise found no existing study that specifically examined the effectiveness of Strategic Intervention Materials in addressing this competency within the school's context. Consequently, there remained a need to generate localized empirical evidence regarding the effectiveness of competency-based Strategic Intervention Materials for improving students' mathematical performance in this specific learning area. Guided by these gaps, the present study evaluated the effectiveness of Strategic Intervention Materials as a competency-based instructional tool for Grade 9 students of Fort Bonifacio High School. Specifically, the study examined students' mathematical performance before and after the implementation of the intervention, determined learning gains across participating groups, and explored learners' insights and learning experiences. The findings are intended to provide evidence that may support the development of improved instructional interventions, innovative teaching strategies, and mathematics support programs for learners experiencing difficulty in mastering essential competencies.

The study primarily aligns with Sustainable Development Goal (SDG) 4 – Quality Education, which promotes inclusive, equitable, and quality education while ensuring lifelong learning opportunities for all. By evaluating the effectiveness of Strategic Intervention Materials in improving learners' mathematical competencies, the study supports efforts to strengthen instructional quality, address learning gaps, and enhance academic achievement among students. These objectives are consistent with educational initiatives that seek to improve foundational learning outcomes through evidence-based instructional practices. The study also contributes to SDG 8 – Decent Work and Economic Growth, as improved mathematical competence strengthens learners' analytical, computational, and problem-solving skills that are increasingly required in higher education and the modern workforce. The importance of mathematics for employment readiness and participation in technology-driven industries has been emphasized through the discussion on the competencies identified by the 2020 World Economic Forum. In addition, the research supports SDG 9 – Industry, Innovation and Infrastructure by encouraging the development and utilization of innovative instructional resources such as Strategic Intervention Materials. The integration of competency-based intervention materials demonstrates an instructional innovation designed to improve teaching effectiveness and learners' academic performance within the educational system.

The significance of this study extends beyond mathematics education by contributing to several dimensions of sustainability. From the perspective of educational sustainability, the study provides evidence on an instructional approach that can strengthen learners' mastery of competencies, improve academic performance, and support continuous improvement in classroom instruction. The findings may assist teachers in designing more effective intervention strategies and enable school administrators to develop programs that respond to learners' academic needs. The study likewise contributes to institutional and policy sustainability by supporting the implementation of Department of Education initiatives that promote remediation, competency-based instruction, and evidence-informed educational decision-making. The findings may serve as a reference for school leaders, curriculum planners, and policymakers in strengthening intervention programs that address learning deficiencies and improve educational outcomes. Furthermore, the research contributes to innovation and digital sustainability by encouraging the development, validation, and utilization of Strategic Intervention Materials, including electronic intervention resources, as innovative teaching tools that enhance student engagement and learning. The study also supports community sustainability by promoting improved educational outcomes that prepare learners with the mathematical competencies necessary for higher education, productive employment, and meaningful participation in society. Finally, by providing localized empirical evidence, the study offers a foundation for future research and continuous innovation in mathematics education, thereby fostering the long-term sustainability of effective instructional practices.

2. Material and methods

2.1 Research Design

The study utilized a mixed-methods approach, specifically an explanatory sequential mixed-methods design, in which quantitative data were collected and analyzed first, followed by qualitative data to explain and expand the quantitative findings (Edmonds & Kennedy, 2017). This approach enabled a comprehensive evaluation of the effectiveness of the Strategic Intervention Materials by combining numerical evidence with students' learning experiences. For the quantitative

phase, a one-group pretest-posttest design was employed to determine the effectiveness of the Strategic Intervention Materials in improving the mathematical performance of six Grade 9 student groups in solving problems involving right triangles. A pretest established the students' baseline performance before the intervention, while a posttest measured learning after the implementation of the Strategic Intervention Materials. Descriptive and inferential statistical analyses were used to determine differences between pretest and posttest scores, evaluate learning gains, and assess the significance of the observed improvements. For the qualitative phase, interviews were conducted to gather students' perceptions, experiences, and insights regarding the use of the Strategic Intervention Materials. The qualitative responses were analyzed through thematic analysis to identify recurring patterns and themes that complemented and explained the quantitative findings, thereby providing a deeper understanding of the intervention's effectiveness. (Edmonds & Kennedy, 2017).

2.2 Locale of the Study

The study was conducted at Fort Bonifacio High School, located at JP Rizal Extension, Barangay West Rembo, City of Taguig. The school served as the research setting because the identified Grade 9 students exhibited learning difficulties in mathematics, particularly in solving problems involving right triangles, making it an appropriate environment for evaluating the effectiveness of Strategic Intervention Materials as a competency-based instructional tool.

2.3 Respondents of the Study

The respondents consisted of Grade 9 students from the six sections handled by the researcher at Fort Bonifacio High School. The total population comprised 197 students, from which 132 respondents participated in the quantitative component of the study. For the qualitative component, 30 students, representing approximately 23% of the respondents, participated in the interview to provide insights into their learning experiences while using the Strategic Intervention Materials.

2.4 Sample and Sampling Procedure

The sample size of 132 respondents was determined using Slovin's Formula with a 0.05 margin of error. After determining the required sample size, simple random sampling was employed to select participants from each of the six Grade 9 sections. Following the principle that every member of the population has an equal chance of being selected, the researcher used the fishbowl technique, in which each student's name was written on a piece of paper and randomly drawn until the required number of respondents per class was obtained. For the qualitative phase, purposive sampling was employed to select 30 students, with five participants representing each class. These respondents were chosen to provide detailed descriptions of their experiences, perceptions, and reflections regarding the implementation of the Strategic Intervention Materials.

2.5 Research Instrument

The primary quantitative instrument was a researcher-developed 30-item test designed to measure the mathematical performance of Grade 9 students in solving problems involving right triangles. The same instrument served as both the pretest and posttest to determine changes in students' performance following the implementation of the Strategic Intervention Materials. Test items were aligned with the Most Essential Learning Competencies (MELCs) and were based on the targeted competency identified as least mastered. Prior to administration, the instrument underwent expert validation to ensure its content validity, clarity, appropriateness, and alignment with the intended learning outcomes. Necessary revisions were incorporated based on the validators' recommendations before the final administration. To establish the reliability of the achievement test, a pilot test was conducted among students with characteristics similar to the actual respondents but who were not included in the study. The reliability coefficient indicated that the instrument possessed acceptable internal consistency, confirming its suitability for measuring students' mathematical performance. For the qualitative component, the researcher utilized a semi-structured interview guide to gather students' experiences, perceptions, and reflections regarding the use of the Strategic Intervention Materials. The interview questions were likewise validated by experts to ensure that they adequately addressed the objectives of the study and elicited relevant responses concerning the effectiveness of the intervention.

2.6 Data Gathering Procedure

Before conducting the study, the researcher secured the necessary approvals from the appropriate school authorities and obtained permission to administer the research instruments. After approval was granted, informed consent was obtained from the participants, and the purpose and procedures of the study were explained to ensure voluntary participation. The quantitative phase began with the administration of the pretest to determine the respondents' baseline mathematical performance. Following the pretest, the Strategic Intervention Materials were implemented during the scheduled mathematics sessions, allowing students to complete the structured learning activities designed to improve mastery of solving problems involving right triangles. Upon completion of the intervention, the same achievement test was administered as the posttest to measure changes in students' mathematical performance. After analyzing the quantitative results, the qualitative phase was conducted. Selected respondents participated in semi-structured interviews to describe their experiences, challenges, and perceptions regarding the use of the Strategic Intervention Materials. The interviews

were documented, transcribed, organized, and prepared for thematic analysis to provide explanations that complemented the quantitative findings.

2.7 Data Analysis Techniques

Descriptive and inferential statistical methods were employed to analyze the quantitative data. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used to summarize respondents' demographic characteristics and describe their pretest and posttest performance. Inferential statistics were utilized to determine the effectiveness of the Strategic Intervention Materials. Appropriate statistical tests were conducted to examine significant differences between the respondents' pretest and posttest scores and to evaluate improvements in mathematical performance following the intervention. Learning gains were likewise analyzed to determine the extent of students' mastery after exposure to the Strategic Intervention Materials. The level of significance was set at 0.05 for all statistical analyses. For the qualitative data, interview transcripts were analyzed using thematic analysis, in which responses were coded, categorized, and synthesized into recurring themes that represented the students' learning experiences and perceptions of the Strategic Intervention Materials. The qualitative findings were subsequently integrated with the quantitative results to provide a more comprehensive evaluation of the intervention's effectiveness (Edmonds & Kennedy, 2017).

2.8 Ethical Considerations

The study adhered to established ethical principles throughout the research process to protect the rights, privacy, and welfare of all participants. Prior to data collection, the researcher secured the necessary approval and permission from the appropriate school authorities to conduct the study at Fort Bonifacio High School. Participants were informed of the objectives, procedures, and voluntary nature of the research before their participation. Informed consent was obtained from all respondents, and participants were assured that they could decline or withdraw from the study at any stage without penalty. The researcher maintained strict confidentiality by ensuring that respondents' identities and personal information were not disclosed in any report or publication. Data collected from the achievement tests and interviews were used solely for academic and research purposes and were stored securely to prevent unauthorized access. During the interview phase, participants were encouraged to provide honest responses without coercion or undue influence. The researcher remained objective throughout the conduct of the study and reported the findings accurately, ensuring that the results reflected the actual data gathered. These ethical practices promoted the credibility, integrity, and trustworthiness of the research while safeguarding the rights and well-being of all participants.

3. Results and Discussion

3.1 Mathematical Performance of Grade 9 Students

3.1.1 Pretest Performance

The pretest results indicated that the Grade 9 students demonstrated low mathematical performance prior to the implementation of the Strategic Intervention Material. Across the six groups, most respondents obtained scores that fell below the expected mastery level in solving problems involving right triangles. The results showed that the respondents possessed limited prior knowledge and experienced difficulty applying mathematical concepts and procedures related to the targeted competency, confirming that the competency was among the least mastered before the intervention. The low pretest performance suggests that students entered the intervention with insufficient conceptual understanding and procedural skills necessary for solving right triangle problems. This finding supports previous studies which reported that mathematics remains a challenging subject because many learners struggle with abstract concepts, problem-solving, and the application of mathematical principles (Gafoor and Kurukkan, 2015; Jameel et al., 2016; Langoban, 2020; Iwuanyanwu, 2021). Likewise, the results are consistent with reports showing that Filipino learners continue to perform below expected proficiency levels in mathematics, emphasizing the need for effective instructional interventions that address least-mastered competencies (Dooma et al., 2024; Acido and Caballes, 2024; Lopez, 2022; Magas, 2023; Dicediquin et al., 2023; Layug et al., 2021).

3.1.2 Posttest Performance

Following the implementation of the Strategic Intervention Material, the respondents' posttest scores showed a marked improvement across all six groups. Most students achieved substantially higher scores than in the pretest, indicating increased mastery of solving problems involving right triangles. The overall performance reflected a considerable enhancement in students' mathematical knowledge and competency after exposure to the intervention, demonstrating that the Strategic Intervention Material effectively supported learning and improved achievement. The improvement in posttest performance indicates that the Strategic Intervention Material provided meaningful learning experiences that enhanced students' conceptual understanding, procedural fluency, and problem-solving skills. The findings corroborate earlier studies which concluded that Strategic Intervention Materials significantly improve students' academic achievement, learning gains, engagement, and mastery of mathematical competencies (Balazo, 2021; Limbago-Bastida & Bastida, 2022; Villar et al., 2022; Salviejo et al., 2014; Paco and Linaugo, 2023; Dumigsi and Cabrella, 2019; Cagape et al., 2023; Schindler et al., 2017; OECD, 2020; Martin et al., 2021; Arpilleda, 2021). The findings also support the principles of Discovery

Learning Theory and Meaningful Learning Theory, which emphasize that learners achieve better understanding when they actively construct knowledge and connect new concepts with prior learning experiences.

3.1.3 Comparison of Pretest Performance Among the Six Groups

The comparison of the six Grade 9 groups revealed that their pretest performance did not differ substantially, with all groups demonstrating low levels of mastery in solving problems involving right triangles. Although slight variations in mean scores were observed, the respondents generally exhibited similar baseline knowledge and mathematical competencies prior to the implementation of the Strategic Intervention Material. The findings indicate that the six groups started the intervention under relatively comparable academic conditions. The comparable pretest performance suggests that the respondents possessed similar learning needs before the intervention, thereby providing a reliable basis for evaluating the effectiveness of the Strategic Intervention Material across all participating groups. The consistently low baseline performance reflects previous findings that Filipino learners continue to experience difficulties in mathematics because of inadequate conceptual understanding, limited problem-solving skills, and challenges in mastering essential competencies (Dooma et al., 2024; Acido and Caballes, 2024; Lopez, 2022; Magas, 2023; Diddiquin et al., 2023; Layug et al., 2021). These results further justify the implementation of competency-based instructional interventions designed to address identified learning gaps.

3.1.4 Comparison of Posttest Performance Among the Six Groups

Following the implementation of the Strategic Intervention Material, all six Grade 9 groups demonstrated improved posttest performance, with each group attaining substantially higher scores than those obtained during the pretest. Although differences in mean scores remained among the groups, the overall results showed that every group benefited from the intervention and achieved higher levels of competency in solving problems involving right triangles. The improvement was evident across all participating classes, indicating that the Strategic Intervention Material effectively enhanced students' mathematical performance regardless of group membership. The consistent improvement across the six groups demonstrates that the Strategic Intervention Material served as an effective instructional resource capable of enhancing students' conceptual understanding and mathematical achievement. These findings support previous research indicating that competency-based intervention materials improve students' academic performance by providing structured learning experiences, increasing engagement, reinforcing mathematical concepts, and promoting mastery of least-learned competencies (Balazo, 2021; Limbago-Bastida & Bastida, 2022; Villar et al., 2022; Salviejo et al., 2014; Paco and Linaugo, 2023; Dumigsi and Cabrella, 2019; Cagape et al., 2023; Arpilleda, 2021). The results likewise reinforce the principles of Discovery Learning Theory and Meaningful Learning Theory, which emphasize that meaningful, guided learning experiences contribute to improved understanding, knowledge retention, and successful problem solving.

3.1.5 Difference Between Pretest and Posttest Scores

The comparison between the respondents' pretest and posttest scores revealed a statistically significant improvement in mathematical performance following the implementation of the Strategic Intervention Material. Across all six Grade 9 groups, the posttest mean scores were consistently higher than the pretest mean scores, indicating that students demonstrated greater mastery of solving problems involving right triangles after participating in the intervention. The statistical analysis confirmed that the observed improvement was significant, suggesting that the gains in performance were associated with the implementation of the Strategic Intervention Material rather than chance. The significant increase in students' achievement demonstrates the effectiveness of the Strategic Intervention Material as a competency-based instructional tool for improving mathematical learning. The structured learning activities, guided exercises, and learner-centered approach enabled students to strengthen their conceptual understanding and procedural skills, resulting in improved problem-solving performance. These findings are consistent with previous studies reporting that Strategic Intervention Materials significantly enhance students' academic achievement, conceptual understanding, and mastery of mathematical competencies (Balazo, 2021; Limbago-Bastida & Bastida, 2022; Villar et al., 2022; Salviejo et al., 2014; Paco and Linaugo, 2023; Dumigsi and Cabrella, 2019; Cagape et al., 2023; Arpilleda, 2021). Furthermore, the results support the propositions of Discovery Learning Theory and Meaningful Learning Theory, which emphasize that active engagement and meaningful connections between prior and new knowledge facilitate improved learning outcomes.

3.1.6 Learning Gains of the Six Groups

The analysis of students' learning gains showed that all six Grade 9 groups achieved positive improvement following exposure to the Strategic Intervention Material. The computed learning gains indicated that students acquired substantial knowledge and demonstrated increased mastery of the targeted competency after completing the intervention. Although the magnitude of learning gains varied slightly among the six groups, every group exhibited measurable progress, reflecting the positive instructional impact of the Strategic Intervention Material on students' mathematical performance. The positive learning gains indicate that the Strategic Intervention Material effectively addressed students' learning deficiencies by reinforcing mathematical concepts through structured and competency-based learning activities. The intervention enabled learners to build upon their prior knowledge, resulting in improved comprehension, increased confidence, and enhanced problem-solving ability. These findings corroborate earlier research demonstrating that intervention materials contribute

to higher learning gains, stronger conceptual understanding, improved engagement, and greater retention of mathematical concepts (Lazo and De Guzman, 2021; Laña, 2023; Balazo, 2021; Limbago-Bastida & Bastida, 2022; Arpilleda, 2021). The results likewise affirm that targeted instructional interventions are effective strategies for addressing least-mastered competencies and improving students' overall mathematics achievement.

3.1.7 Comparison of Learning Gains Among the Six Groups

The comparison of learning gains among the six Grade 9 groups revealed that all groups demonstrated improvement after the implementation of the Strategic Intervention Material. Although variations in the magnitude of learning gains were observed, the statistical analysis indicated that the differences among the groups were not sufficient to suggest unequal effectiveness of the intervention. Overall, the findings show that the Strategic Intervention Material consistently enhanced students' mathematical performance across all participating groups, regardless of class assignment. The comparable learning gains across the six groups indicate that the Strategic Intervention Material provided a uniform instructional benefit to the respondents. This consistency suggests that the competency-based intervention effectively addressed learners' mathematical difficulties regardless of their initial performance levels or classroom grouping. The findings are consistent with previous studies demonstrating that Strategic Intervention Materials improve learning outcomes by providing structured, learner-centered, and competency-based instructional experiences that promote conceptual understanding, engagement, and mastery of mathematical competencies (Balazo, 2021; Limbago-Bastida & Bastida, 2022; Villar et al., 2022; Salviejo et al., 2014; Paco and Linaugo, 2023; Dumigsi and Cabrella, 2019; Arpilleda, 2021).

3.2 Students' Learning Experiences with the Strategic Intervention Material

The qualitative findings revealed that students generally described positive learning experiences after using the Strategic Intervention Material. Analysis of the interview responses identified recurring themes indicating that the intervention improved learners' understanding of mathematical concepts, increased their confidence in solving problems involving right triangles, enhanced classroom engagement, and made mathematics more enjoyable and meaningful. Students also reported that the organized learning activities, clear explanations, and step-by-step exercises enabled them to learn at their own pace while strengthening their problem-solving abilities. These findings support the quantitative results showing improved posttest performance and positive learning gains. The respondents' experiences suggest that the Strategic Intervention Material not only enhanced academic achievement but also fostered learner motivation, confidence, and active participation. The results are consistent with previous studies reporting that competency-based intervention materials improve conceptual understanding, learner engagement, academic confidence, and mathematics achievement through meaningful and interactive learning experiences (Balazo, 2021; Limbago-Bastida & Bastida, 2022; Salviejo et al., 2014; Schunk and DiBenedetto, 2020; Arpilleda, 2021). Furthermore, the students' reflections reinforce the principles of Discovery Learning Theory and Meaningful Learning Theory, which emphasize active participation and the meaningful integration of new knowledge with prior learning experiences as essential conditions for effective learning.

3.3 Integration of Quantitative and Qualitative Findings

The integration of the quantitative and qualitative findings demonstrates that the Strategic Intervention Material effectively improved the mathematical performance of Grade 9 students in solving problems involving right triangles. Quantitative evidence showed significant improvements in posttest performance and positive learning gains across all six groups, while qualitative evidence confirmed that students perceived the intervention as helpful in improving their understanding, confidence, engagement, and problem-solving skills. Together, these findings indicate that the Strategic Intervention Material functioned as an effective competency-based instructional tool for addressing least-mastered mathematical competencies. The convergence of the quantitative and qualitative results provides strong support for the effectiveness of Strategic Intervention Materials in mathematics instruction. The statistical improvements in students' achievement were reinforced by learners' positive experiences, suggesting that the intervention promoted both cognitive and affective learning outcomes. These findings align with previous literature demonstrating that well-designed intervention materials enhance mathematical competence, learner engagement, and academic performance while supporting meaningful and learner-centered instruction (Balazo, 2021; Limbago-Bastida & Bastida, 2022; Villar et al., 2022; Salviejo et al., 2014; Paco and Linaugo, 2023; Dumigsi and Cabrella, 2019; Cagape et al., 2023; Arpilleda, 2021). Overall, the integrated findings affirm that Strategic Intervention Materials constitute an effective instructional innovation for improving mathematics learning among Grade 9 students.

4. Conclusion & Recommendations

The findings of the study demonstrate that the Strategic Intervention Material (SIM) is an effective competency-based instructional tool for improving the mathematical performance of Grade 9 students in solving problems involving right triangles. Students' performance significantly improved from the pretest, which did not meet expectations, to the posttest, which reached a satisfactory level. Although no significant differences were found among the six groups in their pretest, posttest, and mean gain scores, each group exhibited statistically significant improvement after the intervention, indicating that the SIM produced a consistent positive effect across all classes. The quantitative findings were further supported by

qualitative evidence showing that the SIM enhanced students' conceptual understanding, procedural proficiency, confidence, engagement, motivation, and problem-solving skills, confirming its value in helping learners master least-learned mathematical competencies.

Based on the findings, mathematics teachers are encouraged to utilize Strategic Intervention Materials as competency-based instructional tools to assist students in mastering least-learned competencies, particularly in mathematics. Schools and instructional leaders may support the development, validation, and implementation of similar intervention materials to strengthen mathematics instruction and learner achievement. Since some learners still required additional practice and support despite the observed improvements, Strategic Intervention Materials may be complemented with appropriate remediation and differentiated learning activities to address diverse learner needs. Future researchers are likewise encouraged to conduct related studies involving different mathematical competencies, learner groups, and educational settings to further validate and expand the findings of the present study.

Compliance with ethical standards

The authors declare no conflict of interest. This study complied with recognized ethical standards for human-participant research by ensuring voluntary participation with informed consent, the right to withdraw without penalty, and strict confidentiality through anonymous, secure, and aggregated data handling. Given the focus on psychological well-being, procedures were non-invasive, and safeguards were observed to minimize discomfort, with guidance to appropriate support services when needed, and required institutional permissions were secured for instrument use and access to academic records.

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