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Strategic Learning Intervention Package in Teaching Quadratic Equations and Inequalities for Grade 9 Mathematics Learners

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ABSTRACT

The researcher employed a Research and Development (R&D) design to develop a Strategic Learning Intervention Package in quadratic equations and inequalities for Grade 9 Mathematics Learners, which involved 60 students and 3 evaluators. The study examined students' mastery levels and the extent of teaching strategies used, including explicit instruction, cooperative learning, ICT-based instruction, and game-based learning. Findings revealed nine (9) least-mastered competencies, with the lowest on solving quadratic equations by factoring. It was also found out that teachers always used explicit instruction and ICT-based instruction in math teaching while often used cooperative learning and game-based learning strategies. Statistical analysis showed no significant relationship between the level of mastery and the extent of teaching strategies, suggesting other influencing factors. A strategic learning intervention package was developed and evaluated as to its adequacy, content, instructional quality, relevance, and usability and it was found to be highly valid, making it an effective tool for improving student learning. Future studies may explore additional factors affecting student mastery in quadratic equations and inequalities, such as student motivation, learning styles, and external influences.

Keywords: *quadratic equations, quadratic inequalities, strategic learning intervention package, least-mastered competencies*

INTRODUCTION

Mathematics is frequently labeled as a challenging subject to most students. Its abstract nature, complexity, and the need for logical reasoning and problem-solving skills make it more challenging. Despite these difficulties, the need for mastery in mathematics is an essential skill that enhances critical thinking, problem-solving, and analytical reasoning abilities. For it resolves that in reality, every problem has a corresponding solution. Effective teaching strategies, appropriate instructional materials, and meaningful interventions are believed that can help improve mastery in the subject. Thus, strengthening mathematics education is crucial in preparing learners to face real-life challenges with confidence and competence.

Grade 9 Mathematics covered areas in Algebra, Geometry and Trigonometry where learners often encounter difficulties. Mathematics on the ninth grade, is one of the most challenging level among other level in the curriculum, especially in the first quarter lessons that involves algebra. Fundamental concepts

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Volume 2 Issue 4 (April 2026)

in algebra like quadratic equations and inequalities challenged learners at the beginning of the school year. The basic concepts in algebra, factorization, and operations are prerequisite in learning quadratic equations and inequalities. The lack of mastery of these pre-requisite skills and learners' readiness after the pandemic are the primary factors of poor mastery of Grade 9 learners in Mathematics.

Conducting a study on learners' mastery in quadratic equations and inequalities is crucial for some reasons. This topic forms a cornerstone of algebra, impacting learners' ability to progress to higher-level mathematics and related fields like science and engineering. Research in this area can identify pedagogical approaches and learning difficulties that hinder learners' comprehension, giving an idea in developing of more effective teaching strategies and interventions. Additionally, improving learners' mastery of quadratics contributes to a stronger foundation in mathematical reasoning and problem-solving skills, benefiting individuals and society as a whole.

In Programme for International Student Assessment (PISA) 2022, the Philippines achieved an average score of 355 in mathematics, which is significantly below the Organization for Economic Co-operation and Development (OECD) average of 472. These means that only 16% of Filipino learners reached at least Level 2 proficiency in mathematics, indicating basic competency (Philstar Global, 2023). This assessment result suggested a conclusion that proficiency in mathematics in the Philippines is below the standard and one of the challenges faced by the Philippine education system.

In order to address these learning gaps, this study examined the mastery level of the grade 9 mathematics learners and the extent of the teaching strategies as a basis in the development of strategic learning intervention package that may help enhance learners' understanding and engagement in these areas.

This study aimed to determine the level of mastery of Grade 9 learners and the extent of teaching strategies used in teaching Quadratic Equations and Inequalities at Kinam National High School for the School Year 2024–2025. It also sought to develop a Strategic Learning Intervention Package based on the findings. Specifically, the study examined learners' level of mastery in illustrating and solving quadratic equations, identifying roots of quadratic equations, illustrating and solving quadratic inequalities, and solving problems involving these concepts. It also assessed the extent of teaching strategies employed by teachers, as evaluated by learners, in terms of explicit instruction, cooperative learning, ICT-based instruction, and game-based learning. Furthermore, the study investigated the significant relationship between learners' level of mastery and the extent of teaching strategies used. Based on the results, a Strategic Learning Intervention Package was developed and its validity was evaluated in terms of adequacy, content, instructional quality, relevance, and usability.

Literature Review

Mastery in Quadratic Equations and Inequalities

Mastery of quadratic equations and inequalities is crucial for developing strong problem-solving skills in mathematics. These concepts are foundational for understanding algebraic relationships, analyzing graphs, and solving real-world problems. Proficiency in these areas enhances logical reasoning and prepares learners for advanced topics like calculus and applied mathematics, making them essential components of mathematical education.

Quadratic equations and inequalities are fundamental concepts in algebra which is part of the school mathematics curriculum that is compulsory in secondary school mathematics (Kim How et al., 2020). Quadratic equations serve as a bridge between linear equations, functions, and polynomials, providing a foundational understanding that is crucial for further mathematical studies (Tendere & Mutambara, 2020). They help establish connections between various mathematical concepts such as trigonometry, limits, and integrals (Kim How et al., 2022). Quadratic equations and inequalities are used in numerous real-life

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Volume 2 Issue 4 (April 2026)

scenarios, including physics, engineering, and economics. Quadratic equations and inequalities are essential for modeling realistic situations, such as calculating areas, speeds, and profit or loss (Rajendran, 2023).

Several studies point out that the level of mastery that learners achieve in understanding and applying concepts of quadratic equations and inequalities can vary significantly based from the different factors. The absence of understanding in the basic concepts (Thomas & Mahmud, 2021), prior knowledge (Marecek & Mathis, 2020), limited timeframes for learning (O'Connor & Norton, 2022), complexity of quadratic equations (How et al., 2021), and teaching quality and strategies (Baybayon, 2023) are some factors that matter. These factors often interact with each other and can be categorized as complexity of the concept which includes misconception and basic skills; instructional factors include teaching strategies, instructional resources, and time-frame; attitude and interest comes with the lack of motivation and support; and different individual learning styles.

The main factor of poor mastery level in quadratic equations and inequalities is complexity of the concept that deals with the misconception and weak foundation in algebraic manipulation and basic mathematical operations. According to Guner (2017) as cited by How et al. (2022), among the contents in mathematics, the concept of quadratic equation is the most challenging algebraic domain of mastery. In the study of Tendere and Mutambara (2020) on the Analysis of Errors and Misconceptions in the study of Quadratic Equations, the lack of pre-requisite knowledge of basic concepts and skills are found to be the reason why students fail to execute the necessary procedure. Tendere and Mutambara revealed that the difficulties encountered by the students in solving quadratic equations is through factorization method and using quadratic formula. Basic concept such as operations of integers, factorization and substitution must be well addressed to avoid misconceptions in the higher mathematics.

Instructional factors which include teaching strategies, instructional resources, and time-frame are other reasons of poor performance. The quality of instruction, practice opportunities, instructional resources used, enough time for learning, and feedback provided by teachers play a crucial role in enhancing students' mastery of these concepts. According to Kim How et al. (2022) the use of diverse teaching methods, emphasis on Higher Order Thinking Skills (HOTS), blended and inquiry-based learning, real-world applications and contextualization, and the integration of technology (Stein et al., 2020) can enhance the mastery level of students in quadratic equations and inequalities. Moreover, mastery is a dynamic process that can be improved through effective teaching strategies, real-world exposure and the utilization of technology. Regular practice, problem-solving, and exposure to a variety of examples can also help students build confidence and proficiency in quadratic equations and inequalities.

The K to 12 Basic Education Curriculum in Mathematics have sixteen (16) competencies in the first quarter that need to be mastered by the learners at the end of the period. Nine (9) of them involve quadratic equations and inequalities. The competencies are: 1) illustrates quadratic equations; 2) solves quadratic equations by: (a) extracting square roots; (b) factoring; (c) completing the square; (d) using the quadratic formula; 3) characterizes the roots of a quadratic equation using the discriminant; 4) describes the relationship between the coefficients and the roots of a quadratic equation; 5) solves equations transformable to quadratic equations (including rational algebraic equations); 6) solves problems involving quadratic equations and rational algebraic equations; 7) illustrates quadratic inequalities; 8) solves quadratic inequalities; and 9) solves problems involving quadratic inequalities. In this study, these nine (9) competencies are categorized into four, which are: 1) illustrating and solving quadratic equations; 2) roots of quadratic equations; 3) illustrating and solving quadratic inequalities; and 4) solving problems involving quadratic equations and quadratic inequalities. These competencies are identified as Most Essential Learning Competencies (MELCs) since they are fundamental concepts in learning Algebra.

Illustrating and Solving Quadratic Equations

Illustrating and solving quadratic equations are composed of two competencies: a) illustrating quadratic equations; and b) solving quadratic equations. The first competency involves the definition and

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of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

identification of the values of a, b and c of a quadratic equation. The second competency focused on finding the solution or the value of x. The key point of learning these two competencies is to determine the root/s or the solution/s of a quadratic equation (How et al., 2022) in which the solution may be real or complex (Davenport University Library, 2024). According to the Learner's Material for Grade 9 Mathematics, there are four (4) methods in solving quadratic equations that require the skills of factorization, operations of integers, and substitution. These methods include: extracting square roots, factoring, completing the square, and using quadratic formula. The prerequisite skills are crucial in solving quadratic equations as the methods in solving quadratic equations that include factoring, substitution, simplifying, and taking the square roots.

Roots of Quadratic Equations

The topic roots of quadratic equations involve three competencies: characterizes the roots of a quadratic equation using the discriminant; describes the relationship between the coefficients and the roots of a quadratic equation; and solves equations transformable to quadratic equations (including rational algebraic equations). These competencies are grouped together because they commonly point out to the roots of quadratic equations except the last one.

Most learners encounter difficulties in competencies under the topic of roots of quadratic equations. The misunderstanding of the discriminant (Chebli & Samura, 2025) and error in applying the sum and product formulas (Cuemath) are common challenges encountered by the learners. Learners struggle to connect the discriminant's value to whether roots are real, repeated, or complex. Similarly, the study of Makgakga (2023) revealed that learners find it difficult to describe the roots, determine the other root when one root is given, solve quadratic equation written in standard form, represent the roots to determine the value of unknown variables, and execute the reversal process using the given roots to find the equation. Students often misinterpret the discriminant and its role in determining the nature of roots and the relationship between the coefficients and the root. With strong foundational skills, these competencies are easy enough to learn and apply.

Illustrating and Solving Quadratic Inequalities

Quadratic inequalities hold a critical position in secondary mathematics curricula due to its foundational role in algebraic reasoning, problem-solving, and real-world applications. They serve as a bridge between algebraic and graphical reasoning, helping students to connect quadratic equations, functions, and graphs through comparisons of their properties (Muhammad et al., 2023), understand critical concepts like domain, critical values, and interval notation and develop higher-order thinking skills (HOTS) by analyzing inequalities symbolically, numerically, and graphically (Ndlovu, 2020). Quadratic inequalities involve decision making and the concept of comparison, critical values and interval notations.

Quadratic inequalities involve expressions like x^2 (where x is a variable) and inequalities like > (greater than), < (less than), ≥ (greater than or equal to), or ≤ (less than or equal to). In illustrating quadratic inequalities, one can visualize them by presenting a number line or plotting the key values (roots and vertex), and by sketching a parabola where the shaded region below or above the parabola depicts the solution for $a < 0$ or > 0 respectively (Khan Academy, 2023).

Solving quadratic inequalities helps one find the range of x-values that satisfy the inequality (Nagwa, 2024). Solving quadratic inequalities involves finding the solution/s of the variable that satisfies the given inequality. There are steps to easily solve quadratic inequalities. First, making sure the inequality is in the standard form: $ax^2 + bx + c < 0$, $ax^2 + bx + c > 0$, $ax^2 + bx + c \leq 0$ *or* $ax^2 + bx + c \geq 0$. Second, factoring the quadratic expressions if possible. This step helps in finding the critical points where the inequality may change. Third, setting the quadratic inequality expression to equal to zero and solve for x. These values are the critical points where the inequality may change. Fourth, use the critical points to divide the number line into two intervals. Fifth, pick a test point from each interval and substitute it back into the

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of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

original inequality to determine the sign of the expression in that interval. Based on the signs of the expression in each interval, determine the intervals where the inequality is satisfied. Then, express the solution in interval notation or set-builder notation, depending on the format required. The procedure of solving quadratic inequality is quite complicated; that is why students fail to attempt answering.

Solving Problems Involving Quadratic Equations and Quadratic Inequalities

The twin goals of mathematics as stated in the Curriculum Guide are problem solving and critical thinking. Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action, according to Scriven and Paul (1987), cited in Curriculum Guide of Mathematics. Meanwhile, mathematical problem solving, in the words of Polya (1945 & 1962), is figuring out a way around a challenge, a barrier, or an unknown problem. The attainment of these two objectives necessitates a well-structured and strict curriculum, a precisely defined set of advanced abilities and procedures, favorable attitudes and values, and suitable instruments that consider the various learning environments of Filipino learners.

Learners usually disregard tasks that focus on real-life applications like solving problems involving quadratic equations and quadratic inequalities. The study of O'Connor (2024) aimed to understand the reasons behind learners' difficulties in solving quadratic equations and quadratic inequalities. A total of 25 students participated in the research. The overall result proves that in attempt to solve quadratic equations, conventional errors in factorization and basic algebra are evident. Meanwhile, the study of Thomas and Mahmud (2021), which focused on the analysis of students' error in solving quadratic equations and inequalities, out of 30 students who underwent a diagnostic test, only three were selected. The result proves that two errors (comprehension type error and process skill error) are the ones that slow the process of solving skills of the students. These studies prove that certain errors in solving quadratic equations and quadratic inequalities hinder the learner to solve the mathematical problem well.

Mastery of quadratic equations and inequalities is not only academically important but also beneficial for developing problem-solving abilities, analytical skills, higher order thinking skills (HOTS), and applications in various fields. It is a fundamental aspect in mathematics that forms the basis for advanced mathematical concepts and real-world problem-solving.

Strategies Used in Teaching Quadratic Equations and Inequalities

Teaching strategies play a crucial role in the teaching-learning process. They facilitate mastery of quadratic equations and inequalities through effective instruction, enhancing student engagement, and promoting meaningful learning outcomes. The utilization of diverse approaches such as integrating visual tools, fostering higher-order thinking skills, and using real-world applications can help teachers bridge the gaps in understanding the concepts. Strategies that emphasize clarity, active learning, and personalized instruction not only enhance comprehension but also empower learners to apply these mathematical principles confidently in advanced topics and real-life scenarios.

In a journal article by Hasanova et al. (2021), teaching strategy is distinctly defined as a careful plan of teaching activities that ensures effective teaching and learning process and designed to achieve a specific objective. On the other hand, in the study of Kim How et al. (2022), they found out that most teachers used teaching strategies which mainly involve teacher-centered approach that emphasizes the memorization of facts and procedural steps in solving quadratic problems. Another study was conducted by O'Connor et al., (2024) on student errors where they stressed that learners' errors are not just a result of teaching methods and strategies that do not focus on conceptualization, or simply because of insufficient time to employ appropriate strategies. Teachers try to maximize allotted time to master required concepts. Instead of conceptual mastery, merely memorization of facts and procedure were greatly prioritized.

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

Effective teaching-learning is compromised due to limited time allotted in every competency that is why teachers need to choose effective and efficient teaching strategies that will lead to good learning outcomes.

Teaching strategies are crucial in the teaching-learning process due to the following reasons: effective delivery of knowledge, promoting deeper learning, and creating a positive learning environment. Teaching strategies act as the bridge between the vast knowledge a teacher possesses and the effective learning of students. Well-chosen teaching strategies can make complex concepts easier to grasp. Unlike in other subjects, moving forward without mastering the previous concepts in mathematics will make it more difficult. However, choosing the appropriate teaching strategy will effectively deliver the knowledge, promote deeper learning, and create a positive learning environment is a crucial part. There are plenty of teaching strategies to choose from, namely: differentiated instruction, project-based learning, conceptual understanding, explicit instruction, blended learning, inquiry-based learning, cooperative learning, ICT-based learning, game-based learning and among others. The choice of teaching strategies that align with the learning objectives and learners' needs will create a dynamic and engaging classroom environment that promotes not just the acquisition of knowledge, but also the development of critical thinking skills, a love of learning, and a growth mindset among learners.

Explicit Instruction

Explicit instruction, as defined by Gunn et al. (2021), is a set of instructional strategies intended to support students' learning. Greene (2024) simply defines it as a way to teach in a direct and structured way. This teaching strategy provides step-by-step explanations, demonstrations, and guided practice to introduce new mathematical concepts, model problem-solving strategies, and ensure understanding through direct instruction. It also gives students the opportunities of information and skills they need to engage. The teacher gives clear, guided instructions to learners. In that way, teachers clearly demonstrate concepts in mathematics, specifically of what to do and how to do it.

Explicit instruction aims to make learning more structured, focused, and systematic by breaking down complex tasks into smaller, manageable steps, offering clear explanations, modeling examples, and providing guided practice to support learners in acquiring new knowledge and skills effectively. Teachers must constantly engage students in explicit instruction if they want to teach basic skills in an effective manner. Learners receive repeated exposure to and practice with new material and abilities when they engage in frequent interactions. Learners practice accurately when they use language that is concise, easy to understand, and consistent. Often cited examples of explicit instruction include the regular opportunities for practice with scaffolded learning, think-aloud exercises, teacher modeling, and feedback (Gunn et al., 2021).

Cooperative Learning

Cooperative learning is a very effective method in promoting diversity in a mathematics classroom (Brahier, 2020), where learners collaborate in small groups to facilitate one another's learning (Abramczyk & Jurkowski, 2020). Cooperative learning is a teaching method that encourage learners to collaborate in groups or pairs to solve problems, discuss concepts, and explain their reasoning, fostering peer interaction and learning from each other. This approach also helps learners develop confidence in expressing mathematical ideas. With the studies of Brahier and Abramczyk & Jurkowski, it is affirmed that integrating cooperative learning caters both mental and social skills of the learners.

Moreover, cooperative learning is a learning strategy that promotes deeper understanding, collaborative interactions among students in a group, improve communication and collaborative skills, increase motivation and engagement, and develop social skills among group mates. In general, it emphasizes the importance of teamwork, mutual support and shared responsibilities in achieving academic goals.

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

ICT-Based Instruction

Nowadays, technology influences many aspects of life especially in academic, because it has the ability to visualize concepts, provide differentiated instruction, and offer additional practice. According to Vikas and Mathur (2021), technology is a powerful tool to strategically complement teaching but not to replace it. On the other hand, Kim and Lee (2020) stated that the habit of using ICT and the favorable conditions have a beneficial effect on the actual use of ICT for instruction. The trend of using technology in instruction helps teachers in achieving an engaging and interactive classroom environment. It increases learners' participation and enhances positive performance.

The purpose of ICT-based instruction is to utilize digital technologies in the enhancement of teaching and learning experiences. Digital technologies like computers, tablets, smartphones, and internet assist and facilitate in the acquisition of knowledge and skills of the learners. They also offer various services that may aid teachers and students to grasp information. Teachers can design interactive presentations, create an online assessment, and provide access to a variety of data sources and information. Learners can access various sources that offer unlimited information that can help them to understand mathematical concepts. Generally, ICT-based instruction can be utilized to improve teaching procedure and increase learning outcome.

Game-Based Learning

In the twenty-first century, game-based learning trends in education is the widely utilized teaching and learning strategy in all subject areas including mathematics (Hui & Mahmud, 2023; Vankus, 2021). Game-based learning is an instructional technique that incorporates game features into the teaching-learning process, where educational content is presented in the form of games or interactive activities that challenge learners, and improve critical thinking, problem-solving, and decision-making abilities while giving them entertainment. Game-based learning often incorporates elements such as competition, rewards, levels, and collaboration to enhance the learning experience and make it more enjoyable and interactive for learners.

A systematic review was carried out in 2021 by Peter Vankus on the impact of game-based learning in mathematics education on students' affective domain. The study found that most journal articles reported the benefits of game-based learning on students' engagement, enjoyment, motivation, and attitudes. Additionally, Arciosa (2022) indicates that educational games have been found to be effective in fostering mathematical accomplishment including critical thinking, algebraic problem-solving, and reasoning skills.

Learners can explore complex concepts, practice new skills, and apply theoretical knowledge in a practical and engaging idea. On the other hand, teachers can design interactive and engaging classrooms that support a variety of learning styles, encourage student involvement, and develop a deeper comprehension of the subject matter by utilizing the motivational components of games. Game-based learning can be applied in a variety of educational contexts, including K to 12 schools, higher education, and corporate training initiatives, in order to improve learning outcomes and increase learners' engagement and performance.

Development of Strategic Learning Intervention Package

The development of strategic learning intervention package for quadratic equations and inequalities is a key in addressing the common challenges learners encounter with these complex mathematical concepts. The essence of such resource lies in its ability to bridge the gap between abstract theory and practical application. In designing targeted lessons, activities, visual aids, step-by-step problem-solving strategies, and assessment, it aims to foster a deeper understanding and build confidence in learners. This intervention seeks to transform the learning experience from rote memorization to active engagement and critical thinking, empowering learners to master essential competencies in quadratic equations and inequalities.

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

Strategic learning intervention in education refers to targeted and structured approaches designed to address specific areas where students struggle, such as reading, mathematics, or behavioral issues (Anderson, 2024). Learning interventions are tailored to provide additional support, ensuring that students can bridge learning gaps and improve their academic performance (Adonis, 2020; Arpilleda, 2021; Calderwood, 2023). In other words, strategic learning intervention serves as an additional support to both teachers and learners in improving mastery and achieving meaningful learning experience.

Furthermore, the use of intervention material improves learners' mastery of the least mastered competencies. They also and gain significant learning experiences which address gaps on conceptual understanding (Adonis, 2020). Laña (2023) also suggested the use of intervention in the delivery of instruction. Incorporating learning intervention during the delivery of the lessons assists in the development of fundamental knowledge and skills.

In 2020, Luzano conducted a study on the creation and validation of Strategic Intervention Materials (SIMs) covering the chosen topics in Trigonometry of Precalculus Discipline in Senior High School. After identifying the least learned competencies, the concept of creating a SIM to address the learning gaps was developed. He then first prepared the materials and determined the format to be used. The design and development of the material was based on the least-mastered competencies. Series of steps and validation were followed. Luzano discovered that STEM students who are struggling to grasp a particular learning ability can benefit from using SIMs as valid learning resources. In order to ease the learners' challenges, he suggested using SIM as a teacher-support tool and learner-aid material. In addition, Lituañas and Dela Cruz (2024) highlighted that an intervention material is best designed and developed based on the least learned competencies of the learners. These studies show that the development of learning intervention is primarily based on least mastered competencies of the learners and highlights its role in the teaching-learning process in mathematics.

DepEd Order No. 009, s. 2024 was released last June 2024, emphasizing the use of assessment results to formulate appropriate intervention strategies for learners who exhibit learning gaps. The Department of Education (DepEd) continuously prescribes intervention plan and strategies to boost learners' performance across all areas of the curriculum including mathematics. Strategic learning intervention materials play a crucial role in addressing least mastered competencies which result to increase of learners' mastery level. They are an essential tool in education that support significant learning, enhance engagement and improve learning outcomes for learners. Learners increase their mastery level, show progress in their mathematical understanding, and develop an interest in mathematics through the use of strategic learning intervention materials.

The development of strategic learning intervention package addresses particular learning difficulties and improve academic achievement. Learners' least mastered competencies serve as basis in designing intervention. It should aim to provide effective results that meet the need of each learner. Teachers serve as key facilitators of learners' potential abilities and skills that foster long-term learning. These interventions have significance for providing support and encouraging learners to overcome obstacles and realize their full potential.

Validation of Strategic Learning Intervention Package

Validation ensures that the developed package is practically effective in achieving its intended learning outcomes. Rigorous validation processes involve expert reviews which provide crucial evidence of the package's validity. This process is essential in guaranteeing that the learning package truly enhances students' mastery and teachers' instructional performance, maximizing its positive impact to both learners and teachers.

In 2022, a study conducted by Cruz and Rivera found that developing intervention materials based on the identified least learned competencies ensures that the learning intervention material will be done for its purpose; thus, it should more efficient, relevant, and valuable. The study of Suarez and Casinillo (2020)

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

also concluded that SIMs aid in teaching and thereby increase learners' level of understanding. Likewise, Verano and Comighud (2020) highlighted that the development and utilization of SIMs deepen learners' knowledge and understanding of the least mastered competencies. These studies lay evidences that learning interventions are beneficial in the reinforcement of the issue on least-mastered competencies in mathematics. The improvement of learners' performance is the most common advantages of the utilization of learning interventions. In such a way, intervention is always the key in most all hindering issues regarding student achievement.

A study of Lituañas and Dela Cruz (2024) on developing contextualized strategic intervention materials for Grade 6 science learners emphasized the need for validation to ensure that interventions are culturally relevant and effective in specific educational contexts. In another study, validation is crucial to ensure that a learning intervention package achieves its intended outcomes and improve skills (Dos Santos et al., 2022). These studies demonstrate that validation is a critical step in ensuring that the learning interventions are effective and aligned with educational goals.

Validation helps determine whether a learning intervention is achieving its intended goals and objectives. Moreover, it provides feedback and responses in terms of the feasibility of the developed material. By assessing its effectiveness, teachers and developers can ensure that it is producing the desired learning outcomes and meeting the needs of learners. It serves as a quality assurance measure to ensure that the learning intervention meets established standards of quality, relevance, and ethical conduct.

Validation process includes the selection of expert validators and appropriate tool to be used. Experts evaluate the developed material to see to it that it carefully and properly follows the basic principles of developing a learning intervention. In the validation of the developed strategic learning intervention package, criteria like adequacy, content, instructional quality, relevance, and usability are to be taken into consideration.

Adequacy

Adequacy is one of the key factors in measuring the validity level of the developed strategic learning intervention package, specifically on the following criteria: explains and applies concepts and principles; provides sufficient information on each topic; provides enough activities to increase students' knowledge, skills, and attitudes; offers a diverse collection of practice problems designed to be accessible to learners; and provides expected outcome.

The adequacy of learning materials plays a pivotal role in shaping student learning outcomes and academic performance. Studies consistently demonstrate that adequate learning materials significantly influence how well learners grasp concepts, engage with the curriculum, and achieve their academic potential. Therefore, adequacy is a must considered feature in the development of learning intervention materials in order to improved and achieved desired learning outcomes.

Moreover, the adequacy of learning materials significantly impacts student learning outcomes and academic performance by enhancing teaching effectiveness, promoting active learning, and providing necessary resources (Evermeld & Andala, 2023). A comparative study of Pangsuma et al. (2024) indicates that the adequacy of learning materials, such as E-modules and textbooks, significantly influences student learning outcomes. Appropriate learning materials aligned with educational objectives is crucial for enhancing academic performance and achieving better learning outcomes.

Content

Learning materials must align with clearly defined learning objectives to ensure they are relevant and purposeful. This alignment helps in achieving the desired educational outcomes and ensures that the content is appropriate for the intended audience (Moral & Cabigan, 2022). More importantly, scientific approach in developing learning materials ensures that content is systematically structured and evidence-based. This approach enhances the content's validity by providing a clear framework for learning (Yunita

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of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

& Agustini, 2020). Additionally, the key factors influencing the validity level of learning materials in terms of content include alignment with educational standards, clarity and accuracy of mathematical concepts, and relevance to the target audience's needs (Noperta et al., 2020).

The validity of learning materials in terms of content is influenced by several key factors such as alignment with learning objectives and educational standards, the use of scientific approach, and clarity and accuracy of mathematical concepts. Each of these elements contributes to the overall effectiveness and validity of educational materials, ensuring they meet educational standards and enhance student learning outcomes.

Content as a key factor in measuring the validity level of the developed strategic learning intervention package in this study specifically measures the following criteria: aligns with both the competencies and learning objectives set by the curriculum; provides a clear connection between the topics, activities, and the intended learning outcomes; presents facts, concepts, and processes that are accurate, current, and supported by credible sources; incorporates technology-based content, utilizing digital tools, and online resources to enhance learner engagement, understanding, and application of concepts; and integrates assessments that align with the learning objectives and activities.

Instructional Quality

The instructional quality of learning materials significantly influences the overall learning experience by enhancing learners' engagement, satisfaction, and achievement. It can be assessed through several key indicators that ensure their effectiveness and alignment with educational goals. The standards alignment, ensures the materials meet curriculum benchmarks and prepare students for academic success (Bucolo, 2025). Also, materials should exhibit clarity, with logical organization and accessible language (Indiana University, 2024), and foster interactivity through multimedia elements to engage students actively (Marciniak & Rivera, 2021). Similarly, UNESCO (2023) emphasizes the importance of aligning instructional quality indicators with measurable learning outcomes to ensure equitable education. These indicators collectively ensure that learning materials are impactful, inclusive and aligned with both learner needs and academic standards. Studies demonstrate that instructional quality includes standards alignment, clarity, and interactivity in order to meet its purpose to achieve learning success.

Instructional Quality is a key factor in measuring the validity level of the developed strategic learning intervention package in this study. The following criteria: outlines learning objectives that are clearly stated and measurable; arranges lessons and activities in a progressive order to support effective learning; features interactive and stimulating activities that encourage learners' engagement; showcases a visually balanced design, featuring a clear layout and appropriate use of graphics, colors, and fonts; and guides learners through a structured process and gradually building on their prior knowledge.

Relevance

Relevance is a critical factor in the instructional quality of learning intervention materials, as it ensures that the content aligns with learners' needs, interests, and real-world applications. Relevant materials foster engagement by connecting learning objectives to students' personal experiences, making the content more meaningful and impactful.

In 2021, the research conducted by Muna and Kalam on teaching effectiveness emphasizes that integrating culturally and contextually appropriate resources enhances cognitive engagement and reduces classroom disruptions. Relevance supports differentiated instruction by addressing diverse learner preferences and styles. Studies show that materials tailored to specific learner types, such as auditory or visual learners, improve comprehension and retention. Additionally, relevance aids in bridging theoretical knowledge with practical applications, as demonstrated by literature on experiential learning methods like simulations and role-playing exercises.

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

Furthermore, Ribosa and Duran (2022) demonstrate that creating teaching materials with the intent to make them relevant for others enhances both the creator's learning outcomes and the instructional quality of the materials themselves. These findings underscore that integrating relevance into learning intervention materials not only boosts student motivation but also ensures that content is meaningful and applicable across diverse educational contexts.

Relevance is a key factor in measuring the validity level of the developed strategic learning intervention package in this study. This meets the following criteria: incorporates examples and scenarios that align with the learners' environment and lived experiences; provides resources that are designed to meet the diverse learning styles, needs, and paces of learners; presents activities that encourage active student participation and enhance critical thinking; incorporates formative and summative assessments that effectively measure students' understanding and progress; and addresses specific identified learning deficits.

Usability

A literature review of Alghabban and Hendley in 2022, indicates that the usability factor of learning materials significantly impacts the overall learning experience by enhancing user engagement, facilitating effective learning, and ensuring that learners can navigate and utilize resources efficiently, ultimately leading to improved educational outcomes in e-learning environments. Likewise, Torrisi-Steele and Atkinson (2020) claim that usability significantly influences the overall learning experience by enhancing student engagement, motivation, and reducing cognitive load. A positive user experience with learning materials leads to improved learning outcomes and contributes to students' perceptions of their courses and institutions. Furthermore, research highlights that well-designed usability features, like using a QR-code to easily access the material can ensure that digital learning environments are inclusive and equitable for all learners.

Studies consistently demonstrate the advantages of usability factor of the learning materials in improving learning outcomes. Thus, usability is a key factor in measuring the validity level of the developed strategic learning intervention package. It specifically measures the following criteria: ensures ease of use for both teachers and learners; delivers instructions that are simple, clear, and easy to comprehend; provides flexibility to modify its components for different classroom needs; offers content that corresponds with the learners' academic level and cognitive growth; and presents concise and easy-to-understand directions for activities and assessments.

The validation of the developed learning intervention package considers criteria such as adequacy, content, instructional quality, relevance, and usability. These factors help determine the need for the study by assessing whether existing materials are complete, accurate, effective, and aligned with current learning needs. If present resources lack depth, clarity, appropriate teaching strategies, or updated and accessible content, the justification for developing and implementing this package becomes stronger. Overall, evaluating these areas highlights the gaps and weaknesses in current materials and supports the necessity of the study.

Conceptual Framework

This study is anchored on Piaget's Cognitive Development Theory and Constructivist Learning Theory, which emphasize that learners actively construct knowledge through interaction, problem-solving, and experience. Piaget's theory explains that students develop cognitive abilities through stages and processes such as assimilation and accommodation, enabling them to understand complex concepts like quadratic equations and inequalities (Piaget, 1986). These principles support the use of active learning, discovery, and social interaction to enhance students' logical reasoning and mathematical understanding.

Similarly, Constructivist Theory highlights that learners build their own knowledge through meaningful, real-world activities, collaboration, and reflection (McLeod, 2024; University of Buffalo,

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

2025). This approach promotes critical thinking, cooperative learning, and problem-solving, which are essential in mastering mathematical concepts. Both theories emphasize learner engagement and the importance of connecting new knowledge with prior understanding, providing a strong foundation for developing effective learning interventions.

Guided by these theories, the study utilized an Input–Process–Output (IPO) framework. The input includes learners' level of mastery in quadratic equations and inequalities and the extent of teaching strategies such as explicit instruction, cooperative learning, ICT-based instruction, and game-based learning. The process involves identifying least-mastered competencies and developing intervention materials, including teaching guides, learning activities, and assessments. The output is the validation and refinement of the Strategic Learning Intervention Package to ensure its adequacy, content quality, instructional effectiveness, relevance, and usability.

Overall, this framework supports the development of a strategic learning intervention package that enhances learners' understanding, engagement, and mastery of quadratic equations and inequalities.

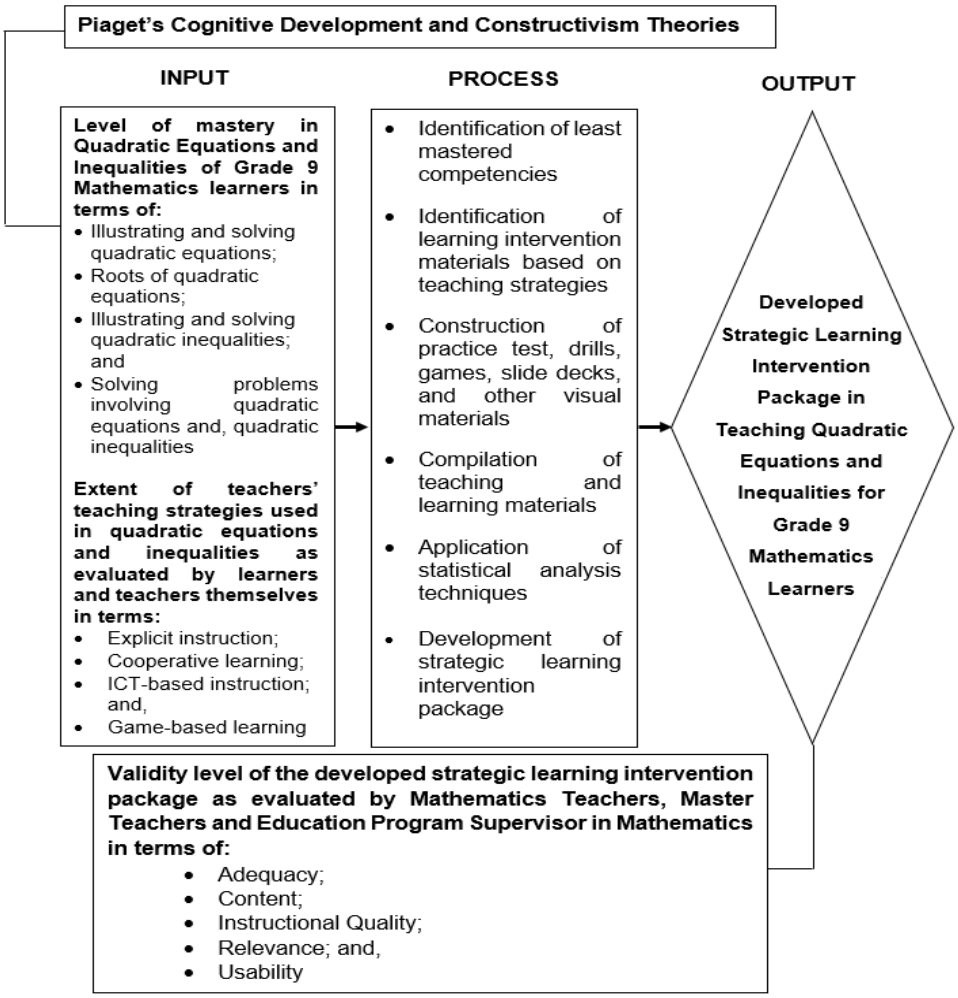

Figure 1. *Conceptual Framework*

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

METHODS

Research Design

This study employed the Research and Development (R&D) design by Borg and Gall (1983) to develop a Strategic Learning Intervention Package based on the least-mastered competencies of Grade 9 learners in Quadratic Equations and Inequalities and the extent of teaching strategies used. This approach is appropriate as it focuses on designing and developing instructional materials to improve teaching and learning processes. A validated test questionnaire was used to determine learners' level of mastery, while a survey questionnaire assessed the extent of teaching strategies, including explicit instruction, cooperative learning, ICT-based instruction, and game-based learning. The results were analyzed to identify least-mastered competencies and examine the relationship between variables. These findings served as the basis for developing the intervention package, which included PowerPoint presentations, activity sheets, guides, and assessment tools. Finally, the developed package underwent a validation process to evaluate its adequacy, content, instructional quality, relevance, and usability, ensuring its effectiveness for Grade 9 Mathematics learners.

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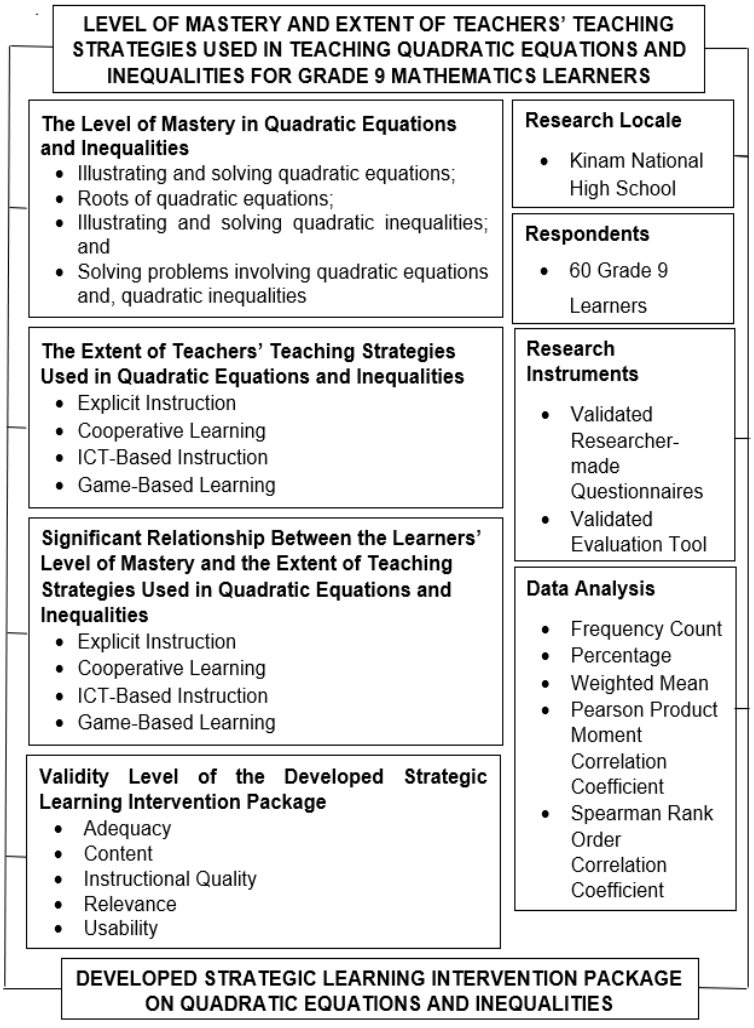


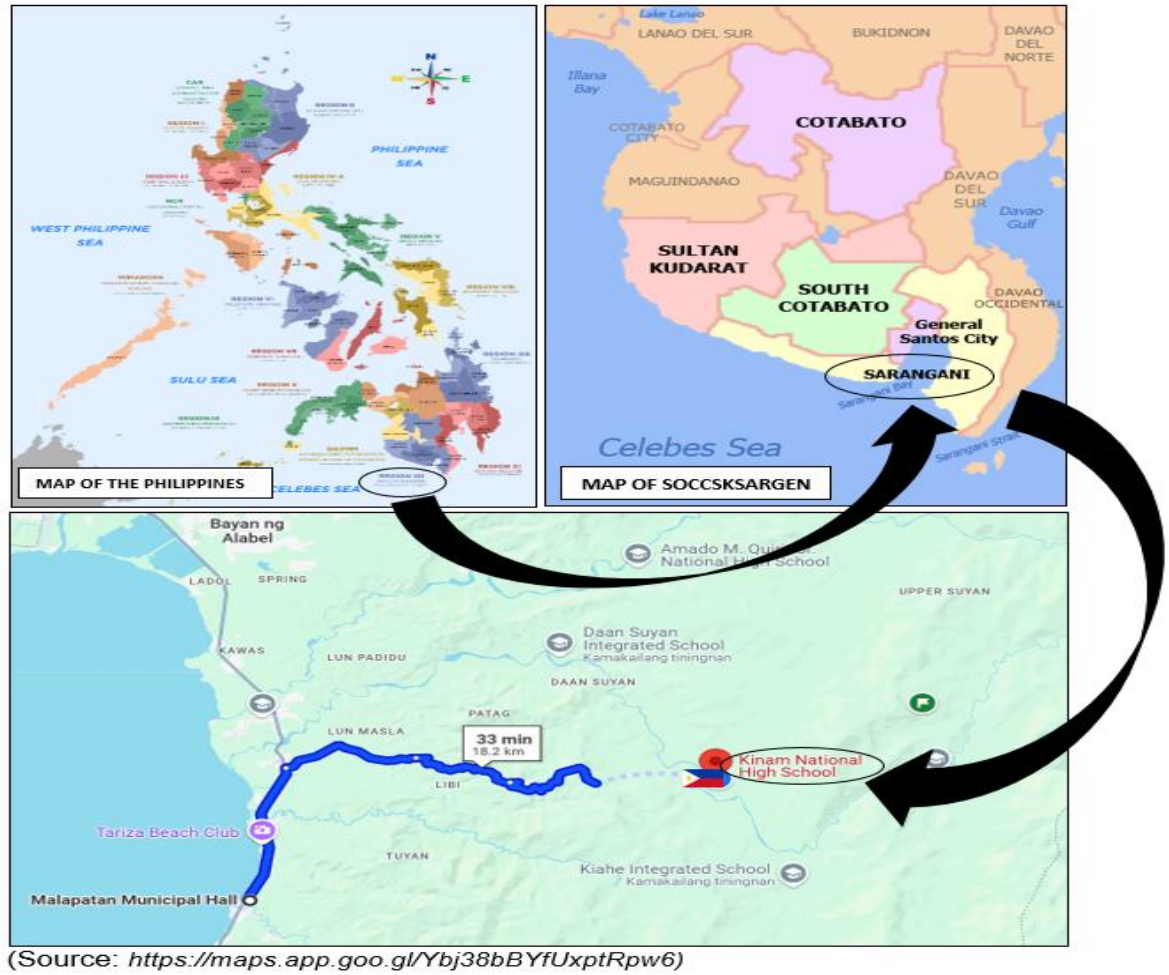
Figure 2. *Research Design*

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

Research Locale

The location of the study had a significant impact on how the research turned out. This study was conducted in Kinam National High School located at Purok D, Brgy. Kinam, Malapatan, Sarangani Province. The school is a medium secondary school located in a mountainous and remote area with a picturesque setting. It is situated in a Blaan community and considered as one of the far-flung schools in Malapatan III District of the Division of Sarangani. The school is offering a complete Junior High School and Senior High School with a total of 360 enrollees and sixteen percent (16%) are Grade 9. Since the school is located in the Blaan community, ninety-eight percent (98%) of the students belongs to Indigenous People, which came from 20 nearby sitios in Barangay Kinam. Previously, the school can only be reached through walking and riding a horse or truck, crossing the river 15 times for 3-4 hours. But recently, because of the construction of new concrete road going to Barangay Kinam, the school is now reachable in just 30-45 minutes which is approximately 20 kilometers from the National highway.

Mathematics teaching in the school mainly emphasizes basic concepts and simple operations, especially after the challenges brought by the pandemic. Most students are still developing their numeracy skills. They understand basic ideas but need more support and practice to gain fluency and accuracy with



(Source: *https://maps.app.goo.gl/Ybj38bBYfUxptRpw6*)

Figure 3. *Map of the Locale of the Study*

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

Selection Process

The selection process of this study is purposive sampling to determine the respondents, ensuring that only individuals with direct relevance to the research objectives were included. Specifically, Grade 9 Mathematics learners were selected based on their involvement in the learning of quadratic equations and inequalities. This sampling method allowed the researcher to focus on respondents who could provide valuable insights into the relationship between teaching strategies and learners' mastery levels. The inclusion criteria considered factors such as the respondents' experience with the subject matter, their engagement with various instructional methods, and their ability to contribute meaningful data to the study.

Respondents

In order to realize the data collection of this study, the researcher carefully considered its respondents to get reliable data. The respondents of this study were the sixty (60) Grade 9 learners of Kinam National High School enrolled in the school year 2024-2025. The respondents were properly chosen in taking their part in the study in order to ensure the reliability of the result. For the validation of the learning package, three identified experts in mathematics were chosen to validate. The identified validators were a master teacher, a professor, and an education program supervisor. Their expertise ensured that the learning package was reviewed thoroughly and met the standards needed for effective instructional use.

Research Instruments

80.01%-100.00%	Very High	The learners have a very good performance in learning quadratic equations and inequalities.
60.01%-80.00%	High	The learners have a good performance in learning quadratic equations and inequalities.
40.01%-60.00%	Moderately High	The learners have a fair performance in learning quadratic equations and inequalities.
20.01%-40.00%	Low	The learners have a poor performance in learning quadratic equations and inequalities.
0.00%-20.00%	Very Low	The learners have a very poor performance in learning quadratic equations and inequalities.

The researcher used different research instruments in this study to answer the research questions. First, is the researcher-made test design to specifically measure the level of mastery of students on quadratic equations and inequalities. The test items are equally distributed to the learning competencies that involves quadratic equations and inequalities.

To evaluate the level of mastery in Quadratic Equations and Inequalities, the following scale were used to quantify the data:

Second, is the survey questionnaire designed for learners to determine the extent of teaching strategies used during instruction. The survey questionnaire was composed of specified descriptions of teaching strategies usually used in mathematics instruction such as explicit instruction, cooperative learning, ICT-based instruction and game-based learning,
selected by the researcher. Each of the four teaching strategies were composed of five (5) indicators formulated by the researcher. There is a total
of 20 indicators which measured the extent of teaching strategies used. In each indicator, the respondents indicated their agreement and disagreement using the 5-point Likert scale, 5 being the highest and 1 being

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

the lowest. These research instruments were believed to be more typical and efficient in gathering significant data for this study. The researcher-made test and questionnaire undergone a reliability test before the administration to the said respondents.

Lastly, the researcher used a validated researcher-made evaluation tool for the evaluators to validate the strategic learning intervention package based on the following indicator: adequacy, content, instructional quality, relevance and usability. In the evaluation of the package, the researcher used a 5-point Likert scale to check if the package accurately satisfies the requirements.

Mean Range	Description	Interpretation
4.21 – 5.00	Very High	The validity of the learning package is excellent.
3.41 – 4.20	High	The validity of the learning package is good.
2.61 – 3.40	Moderate	The validity of the learning package is average.
1.81 – 2.60	Low	The validity of the learning package is poor.
1.00 – 1.80	Very Low	The validity of the learning package is very poor.

Mean Range	Description	Interpretation
4.21 – 5.00	Always	The teachers' strategy is very highly utilized in teaching quadratic equations and inequalities.
3.41 – 4.20	Often	The teachers' strategy is highly utilized in teaching quadratic equations and inequalities.
2.61 – 3.40	Sometimes	The teachers' strategy is moderately utilized in teaching quadratic equations and inequalities.
1.81 – 2.60	Seldom	The teachers' strategy is very poorly utilized in teaching quadratic equations and inequalities.
1.00 – 1.80	Never	The teachers' strategy is poorly utilized in teaching quadratic equations and inequalities.

Data Gathering Procedure

In gathering the data for this study, the following procedures were followed: The researcher formulated a test questionnaire and survey questionnaire based on the needed data and have it validated by the experts. Afterwards, a letter of permission was forwarded to the office of Schools Division Superintendent of Sarangani to request consent. After the approval of the SDS, a letter of permission was sent to the School Head of Kinam National High School. Right after the authorities' approval and parents' approval through the parents' consent, the test questionnaire and survey questionnaire were administered to the Grade 9 learners. A short orientation was conducted to give a clear view of the study. Additionally, each learner had to accomplish the questionnaires within a specified time. All the gathered data were analyzed and interpreted accordingly.

Data Analysis

The following were the statistical tools employed in this study and tested at 0.05 level of significance:

To determine the level of mastery in Quadratic Equations and Inequalities of Grade 9 Mathematics learners, the researcher used frequency count, percentage, and weighted mean. To determine the extent of teachers' teaching strategies used in quadratic equations and inequalities as evaluated by the learners, the researcher used frequency count and weighted mean. To determine the significant relationship between the

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

learners' level of mastery and the extent of teaching strategies, the data underwent a normality test. The researcher used Pearson Product Moment Correlation Coefficient in normal data with a p-value greater than 0.05 level of significance. Spearman Rank Order Correlation Coefficient was used with the data which is less than 0.05 level of significance. Lastly, to determine the validity level of the developed strategic learning intervention package, the researcher used frequency count and weighted mean. Generally, these statistical tools helped provide a clear and reliable result basis for further action of this research.

Ethical Considerations

This study adhered to ethical standards mandated by Holy Trinity College to ensure the protection and welfare of all participants. Informed consent was obtained from parents or guardians prior to data collection, and respondents were fully informed of the study's purpose, procedures, and their right to withdraw at any time. Participation was voluntary, allowing respondents to decide freely based on their understanding of the research. Confidentiality and data privacy were strictly maintained by anonymizing responses and ensuring that all collected data were used solely for research purposes. No identifying information was required, and appropriate measures were taken to safeguard participant information. The study also observed gender and cultural sensitivity. All respondents were treated equally regardless of gender, and the research instruments were validated to avoid bias. Cultural respect was emphasized, particularly as many respondents belonged to Indigenous People (IP) groups, ensuring that their perspectives and beliefs were handled with fairness and respect throughout the study.

RESULTS AND DISCUSSIONS

The Level of Mastery in Quadratic Equations and Inequalities of Grade 9 Mathematics Learners

The following tables present the level of mastery of grade 9 mathematics learners in terms of the following topics of quadratic equations and inequalities: a) illustrating and solving quadratic equations; b) roots of quadratic equations; c) illustrating and solving quadratic inequalities; and d) solving problems involving quadratic equations and quadratic inequalities.

Table 1.1. *Level of Mastery in Quadratic Equations and Inequalities of Grade 9 Mathematics Learners in Terms of Illustrating and Solving Quadratic Equations*

Items	No. of Items	f	%	Description
1. Illustrates quadratic equations	*3*	*133*	*76.44*	High
2. Solves quadratic equations by extracting square root	*4*	*82*	*35.34*	Moderately High
3. Solves quadratic equations by factoring	*4*	*50*	*21.55*	Low
4. Solves quadratic equations by completing the square	*2*	*78*	*67.24*	High
5. Solves quadratic equations by using the quadratic formula	*2*	*31*	*26.72*	Low
Overall Mean			*42.99*	Moderately High

Table 1.1 presents the level of mastery of grade 9 mathematics learners in terms of illustrating and solving quadratic equations. The data reveal that the grade 9 learners exhibit high mastery in illustrating quadratic equations *(76.44%)* and solving them by completing the square *(67.24%),* indicating strong mastery and effective instructional strategies in these areas. However, mastery is moderately high for

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

solving by extracting square roots *(35.34%)* and notably low for solving by factoring *(21.55%)* and using the quadratic formula *(26.72%).*

The results suggest that grade 9 learners struggle with procedural fluency and complex calculations, particularly in factoring and applying the quadratic formula. Solving quadratic equations by factoring got the lowest percentage mean of *21.55%* which emphasizes learners insufficient understanding in this area. Overall, the moderately high mean score of *42.99%* reflects a need for targeted interventions to strengthen problem-solving skills and procedural accuracy.

Based on the study of Kabar (2023), students perform well in representing quadratic equations but they struggle with procedural tasks like factoring and using the quadratic formula. Also, a study in Malaysia showed that traditional teacher-centered approaches prioritize memorization over conceptual understanding which resulted to these difficulties (Kim et al., 2022). Additionally, a cross-national study by Chaachoua et al. (2025) revealed that variations in curriculum structure and teaching methods greatly influence learners' ability to apply different solution strategies for quadratic equations. In general, these findings emphasize the need for interactive and conceptually driven instructional approaches to improve students' procedural fluency.

Table 1.2. *Level of Mastery in Quadratic Equations and Inequalities of Grade 9 Mathematics Learners in Terms of Roots of Quadratic Equations*

Items	No. of Items	f	%	Description
1. Characterizes the roots of a quadratic equation using the discriminant	*3*	*62*	*35.63*	Low
2. Describes the relationship between the coefficients and the roots of a quadratic equation	*3*	*60*	*34.48*	Low
3. Solves equations transformable to quadratic equations	*6*	*96*	*27.59*	Low
Overall Mean			*31.32*	Low

Data from Table 1.2 revealed the grade 9 learners' mastery levels for quadratic equations and inequalities, particularly regarding their competency with the roots of quadratic equations. Examination of the data indicated that mastery was low across all items, although the learners performed best, if one can call it that, on item 1 (characterizing roots using discriminants) at *35.63%* and item 2 (describing the relationship between coefficients and the roots of a quadratic equation) at *34.48%.* Their performance was wretched on a third item (solving equations transformable to quadratic equations) at *27.59%.* Overall, grade 9 mastery for the items in this table was about as good as a failing grade: *31.32%.*

The results support Vygotsky's Sociocultural Theory (1962), which posits that interaction and assistance are vital for effective learning. They suggest that our learners might not be receiving sufficient help or a sufficiently rich environment for effective learning. They also suggest, because of what our low mastery levels reflect, that perhaps the bridge to algebra course is not doing a very good job of serving the students who will be taking intermediate algebra course. Additionally, Piaget's Theory of Cognitive Development (1936) emphasizes that individuals in the age group are moving (if they have not already) into the formal operational stage, where they can and do handle the kind of abstract thinking that quadratic equations, their solutions, and the structure of those solutions demand.

However, the low scores indicate that many learners may still need concrete, hands-on methods to fully grasp these abstract mathematical concepts. Additionally, the results align with Skinner's Behaviorist Theory (1938), which highlights the importance of reinforcement in the learning process. The lack of mastery suggests that consistent feedback and positive reinforcement, crucial for skill development, may not have been effectively applied. These theories highlight the necessity for targeted interventions, such as scaffolding, differentiated instruction, and reinforcement, to help learners master quadratic equations and

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

inequalities. Implementing such interventions can provide learners with the structured support they need to gradually build confidence and achieve higher levels of mathematical understanding.

Table 1.3. *Level of Mastery in Quadratic Equations and Inequalities of Grade 9 Mathematics Learners in Terms of Illustrating and Solving Quadratic Inequalities*

Items	No. of Items	f	%	Description
1. Illustrates quadratic inequalities	*3*	*65*	*37.36*	Low
2. Solves quadratic inequalities	*6*	*77*	*22.13*	Low
Overall Mean			*27.20*	Low

The data in Table 1.3 present the mastery level of grade 9 learners in illustrating and solving quadratic inequalities. Both competencies, illustrating and solving quadratic inequalities are described as Low with *37.63%* and *22.13%*, respectively. The overall mean of *27.20%* suggests significant challenges among the grade 9 learners in comprehending the concept and procedural application of quadratic inequalities. These difficulties hinder their ability to master the foundational skills and grasp the complex ones.

Some common errors in solving quadratic inequalities revealed in the study of Mamba (2020) involved expressing compound inequalities, representing solutions as interval, and generalizing equality to inequality. Mutodi et al. (2023) added that common learners' errors in solving quadratic inequalities are due to misunderstanding from prior learning and insufficient mathematical content knowledge. Smith et al. (2022) also found that learners who have difficulty with basic concepts of Algebra like inequalities and equations often struggle with more advanced topics. These studies implicate that most of the learners commit errors in solving quadratic inequalities which is due to weak foundational skills in Algebra which hinder comprehension and mastery.

Table 1.4. *Level of Mastery in Quadratic Equations and Inequalities of Grade 9 Mathematics Learners in Terms of Solving Problems Involving Quadratic Equations and Quadratic Inequalities*

Items	No. of Items	f	%	Description
1. Solves problems involving quadratic equations and rational algebraic equations	*12*	*176*	*25.29*	Low
2. Solves problems involving quadratic inequalities	*2*	*37*	*31.90*	Low
Overall Mean			*26.23*	Low

The Table 1.4 shows the level of mastery of grade 9 mathematics learners in solving problems involving quadratic equations and quadratic inequalities. The data reveal that the learners exhibit a low level of mastery in both competencies. Only *25.29%* of learners were able to correctly solve problems involving quadratic equations and rational algebraic equations and *31.90%* for solving problems involving quadratic inequalities. The overall mean score of *26.23%* indicates a low mastery among students. These results imply the challenges faced by the grade 9 learners in applying the concept to solve quadratic-related problems, which affect their performance in mathematics. This highlights the need for targeted instructional strategies to improve learners understanding in problem-solving skills.

According to Polya's Problem-Solving Theory (1957), to solve mathematical problems effectively, it must involve a systematic approach: understanding the problem, devising a plan, executing it, and evaluating the solution. A step-by-step process should be followed to come up with a correct answer. The benefits of inquiry-based learning approaches in improving students' problem-solving skills in algebra

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

indicate that interactive and engaging teaching methods could lead to better outcomes (Thompson, 2022). The study of Thompson lead to the implication that learners with low mastery levels may struggle at one or more of these stages, especially when it comes to translating real-world problems into mathematical sentences.

Table 1.5. *Summary Results on the Level of Mastery in Quadratic Equations and Inequalities of Grade 9 Mathematics Learners*

Indicators	No. of Items	f	%	Description
1. Illustrating and Solving Quadratic Equations	*15*	*374*	*42.99*	Moderately High
2. Roots of Quadratic Equations	*12*	*218*	*31.32*	Low
3. Illustrating and Solving Quadratic Inequalities	*9*	*142*	*27.20*	Low
4. Solving Problems Involving Quadratic Equations and Quadratic Inequalities	*14*	*213*	*26.23*	Low
Overall Mean			*32.66*	Low

Table 1.5 summarizes the level of mastery of grade 9 mathematics learners in quadratic equations and inequalities. The results show that there are two different levels of mastery among these learners, moderately high and low. The highest proficiency was in Illustrating and Solving Quadratic Equations with a score of *42.99%* indicating a moderately high level of mastery. In the topic of Roots of Quadratic Equations, learners showed a low mastery level of *31.32%.* The proficiency in Illustrating and Solving Quadratic Inequalities was even lower at *27.20%.* Lastly, for Solving Problems Involving Quadratic Equations and Inequalities, the mastery level was also low at *26.23%.* In summary, the overall mean score across all indicators was *32.66%,* which categorizes the learners' mastery level as low.

Generally, the results imply that the grade 9 learners are struggling in learning quadratic equations and inequalities. The topic illustrating and solving quadratic equations was marked moderately high while the other three topics: roots of quadratic equations, illustrating and solving quadratic inequalities and solving related problems reflected low mastery, indicating that learners are struggling more in these areas, which badly need some interventions.

Extent of Teachers' Use of Teaching Strategies in Quadratic Equations and Inequalities

The following tables present the results of the extent of teachers' teaching strategies used in quadratic equations and inequalities as evaluated by learners in terms of explicit instruction, cooperative learning, ICT-based instruction and game-based learning. The data are based on a 5-point scale with a corresponding description of the mean.

Table 2.1. *Extent of Teachers' Use of Teaching Strategies in Quadratic Equations and Inequalities as Evaluated by Learners in Terms of Explicit Instruction*

Items *The teacher…*	Mean	Description
1. states the learning objectives at the beginning of the lesson clearly.	*4.95*	Always
2. models the concepts with clear explanations.	*4.91*	Always
3. provides opportunity to practice in applying the new knowledge or skills.	*4.72*	Always
4. provides prompt and specific feedback to learners to support learning.	*3.98*	Often

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

5.	engages in the learning process through asking questions, involving in the discussions, and interactive activities.	*4.62*	Always
Overall Mean		*4.64*	Always

Table 2.1 shows learners' evaluations of teachers' use of explicit instruction in teaching quadratic equations and inequalities. The overall mean of *4.64*, interpreted as Always, indicates that teachers consistently applied explicit instruction strategies.

The teacher received a description of Always in the following items: 1) states the learning objectives clearly at *4.95*; 2) model's concepts with clear explanations at *4.91*; 3) provides opportunity to practice at *4.72,* and 5) engages in the learning process through interactive discussions at *4.62.* In providing prompt feedback, teachers got a mean score of *3.98* described as Often. These suggest teachers need to critically assess their feedback methods to ensure learners' feedback as timely, specific and helpful.

The findings of Nader (2024) support the effectiveness of explicit instruction in improving learners' mathematics proficiency, particularly in procedural fluency and problem-solving. Explicit instruction, as a systematic approach, positively impacts learners' comprehension and performance. Similarly, a research update from the Centre for Education Statistics and Evaluation (CESE) and the University of Queensland highlights the long-term benefits of explicit teaching on student motivation and engagement, confirming its influence on learners' performance.

Table 2.2. *Extent of Teachers' Use of Teaching Strategies in Quadratic Equations and Inequalities as Evaluated by Learners in terms of Cooperative Learning*

Items *The teacher…*	Mean	Description
1. engages the learners in group activities or tasks.	*3.60*	Often
2. acts as a learning facilitator.	*4.09*	Often
3. values the expressions of differing opinions.	*4.07*	Often
4. encourages the learners in exchanging ideas and helping each other to learn.	*4.10*	Often
5. acknowledges team effort and accomplishment.	*4.31*	Always
Overall Mean	*4.03*	Often

Table 2.2 presents the result of the learners' evaluation on the extent of using cooperative learning strategy in teaching quadratic equations and inequalities. Specifically, the data reveal that in engaging the learners in group activities or tasks learners rated *3.60*, teacher as a learning facilitator at *4.09*, values differing opinions at *4.07,* and encourages exchanging ideas and helping each other at *4.10*, all described as Often. However, in acknowledging team effort and accomplishment learners rated their teachers at *4.31* described as Always. The overall mean of *4.03*, interpreted as Often was lower and suggests that cooperative learning was used frequently in an effective manner. These results suggest that learners believed that the use of cooperative learning strategy is not consistently implemented during instruction by their teachers. The results also imply that materializing group activities, the teacher could focus more in facilitating consistent group activities to ensure all students are actively engaged.

In 2024, Ndebil and Ali conducted a quasi-experimental study on the impact of cooperative learning on students' mathematics performance and attitudes. The study showed that cooperative learning enhances both academic achievement and positive attitudes towards mathematics. Similarly,
the study of Klang et al. (2021) revealed significant effects of cooperative learning on student performance in problem-solving and also found that social acceptance and friendships positively influenced students' performance. Additionally, the Teaching and Learning Transformation Center at the University of Maryland (2024) notes that assigning specific roles within groups like manager, recorder, spokesperson,

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

and reflector can foster accountability and encourage active participation from all group members. These studies collectively demonstrate the effectiveness of cooperative learning in enhancing mathematics achievement, problem-solving skills, and positive attitudes. However, the variations in how often cooperative learning are integrated in the classroom is the key to its advantages.

Table 2.3. *Extent of Teachers' Use of Teaching Strategies in Quadratic Equations and Inequalities as Evaluated by Learners in Terms of ICT-based Instruction*

Items *The teacher…*	Mean	Description
1. integrates technology during classroom instruction.	*4.90*	Always
2. uses technology in the class.	*4.83*	Always
3. is proficient in using ICT tools.	*4.84*	Always
4. assesses learners using ICT tools.	*3.81*	Often
5. uses the available ICT tools effectively.	*4.69*	Always
Overall Mean	*4.61*	Always

Table 2.3 shows the evaluation of learners on the extent of using ICT-based Instruction in teaching. The evaluation of ICT-based teaching strategies in the context of quadratic equations and inequalities reveals strong utilization of technology in the classroom instruction, with overall mean of *4.61* described as Always. Specifically, the results on the integration and usage of technology during class instruction are at *4.90* and *4.83* respectively, teachers' proficiency in using ICT tools at *4.84*, and effective use of available tools at *4.69*. However, the use of ICT tools in assessing learners rated at *3.81* was Often observed by the learners.

The data reveal a robust implementation of ICT-based teaching strategies, with high marks on integrating technology and using it effectively in instruction. However, the discrepancy regarding the use of ICT in assessments may point to a lack of visible or consistent use of ICT for assessments in the classroom, an area that may require further attention.

In a study conducted by Nteziryimana and Niyobuhungiro in 2023, students taught with ICT tools performed better in mathematics. Salmaini et al. (2020) also agree that students who learn through ICT assisted learning is better than students who are taught through conventional learning. However, the notable gap in using ICT in assessments aligns with the findings of Botero et al. (2020) on the challenges and opportunities of ICT-based assessment during virtual teaching-learning process. It was highlighted in their study that ICT tools such as automated formative assessments provide immediate feedback, while digital concept mapping supports critical thinking. However, challenges include digital literacy gaps among teachers and students, as well as access to reliable technology. With these studies, ICT-based instruction was found to be effective in the teaching-learning process despite the challenges such as access to technology and digital literacy for broader implementation.

Table 2.4. *Extent of Teachers' Use of Teaching Strategies in Quadratic Equations and Inequalities as Evaluated by Learners in Terms of Game-based Instruction*

Items *The teacher…*	Mean	Description
1. integrates game/s and reward during class instruction.	*3.52*	Often
2. uses games to facilitate learning resourcefully.	*3.59*	Often

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

3.	creates interactive and engaging class environments.	*4.41*	Always
4.	uses game to assess learning.	*3.71*	Often
5.	allows learners to explore concepts, practice new skills and apply gained knowledge.	*4.43*	Always
Overall Mean		*3.93*	Often

Table 2.4 shows the learners' evaluation result on teachers' use of Game-based Learning. The learners provided a moderate rating in integrating games and reward with a mean of *3.52*, using games to facilitate learning with a mean of *3.59*, and to assess learning with a mean of *3.71* all described as Often. In creating interactive and engaging class with a mean of *4.41* and allowing learners to explore, practice and apply concepts have a mean of *4.43*, are both interpreted as Always. The overall mean of *3.93* reflecting Often indicates that Game-based learning is frequently used by teachers during mathematics instruction.

Based on the study of Paglomutan (2024), game-based strategies provided a strong influence in maximizing learning mathematics. Participants reported meaningful experiences, finding the lessons both engaging and rewarding. Likewise, the study of Cayang and Ursabia (2024) concluded that game-based learning enhanced students' academic performance in mathematics, encouraging teachers to integrate such strategies into their instructions. The potential of integrating game-based learning to mathematics education will make learning experiences more effective and achieve learning outcomes.

Table 2.5. *Summary Results on the Extent of Teachers' Use of Teaching Strategies in Quadratic Equations and Inequalities as Evaluated by Learners*

	Indicators	Mean	Description
1.	Explicit Instruction	*4.64*	Always
2.	Cooperative Learning	*4.03*	Often
3.	ICT-based Instruction	*4.61*	Always
4.	Game-based Learning	*3.93*	Often
Overall Mean		*4.30*	Always

Table 2.5 summarizes the results of the evaluation of the extent of various teaching strategies used by teachers. The overall mean of *4.30* indicates that these strategies are being implemented Always with a slight discrepancy in cooperative learning and game-based learning, as indicated by the means for each category.

In Explicit Instruction, learners rated this strategy highly with the rating of *4.64* described as Always. This suggests that explicit instruction, including clear objective setting, modeling of concepts, and frequent feedback, are consistently applied across lessons. The high ratings underscore the importance of structured and clear teaching practices in the classroom.

In Cooperative Learning, learners rated this strategy with a moderate rating of *4.03* described Often. This implies that cooperative learning is frequently observed by the learners during instruction. This points to an area where teachers could enhance the visibility and frequency of cooperative learning activities to align better with learners' experiences.

In ICT-based instruction, learners rated this strategy highly with the rating of *4.61* described as Always. This suggests effective use and integration of technology in teaching resulted to positive impact to learning.

In Game-based Learning, learners evaluated this strategy with *3.93* rating described as Often. This suggests that frequent use of game-based learning in teaching might imply that even though games are utilized, they are not fully recognized as a core part of the learning process.

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

In summary, the results show that learners view explicit instruction and ICT-based instruction as the most consistently applied strategies. However, cooperative learning and game-based learning are less consistently applied. Teachers might consider increasing the visibility and frequency of cooperative and game-based learning activities to better align with learners' experiences and expectations. These elements of teaching can be improved to enhance instruction and create a more engaging learning environment. Such adjustments may also support greater learner participation, collaboration, and overall achievement in mathematics.

Significant Relationship Between the Learners' Level of Mastery and the Extent of Use of Teaching Strategies in Quadratic Equations and Inequalities

The following tables present the relationship between the learners' level of mastery and the extent of use of teaching strategies in quadratic equations and inequalities in terms of explicit instruction, cooperative learning, ICT-based instruction, and game-based learning.

Table 3.1. *Significant Relationship Between the Learners' Level of Mastery and the Extent of Use of Teaching Strategies in Quadratic Equations and Inequalities for Grade 9 Mathematics Learners in Terms of Explicit Instruction*

Variable	Level of Mastery in Quadratic Equations and Inequalities		
	Correlation Coefficient (r_s)	p-value	Remarks
Explicit Teaching	*0.087*	*0.517*	Not Significant

Table 3.1 presents the correlation between learners' level of mastery and the extent of teaching strategies in quadratic equations and inequalities, along with the corresponding correlation coefficient, p-value and remarks. The data reveal a correlation coefficient (r_s) of *0.087*, which is very weak, and a p-value of *0.517*, indicating that the relationship is not statistically significant.

This finding is consistent with recent studies showing that the simple presence or frequency of teaching strategies does not automatically translate to improved academic performance. For instance, Dela Cruz and Reyes (2021) found that although teachers reported using varied instructional strategies in junior high school mathematics, these strategies showed no significant relationship with students' problem-solving proficiency when foundational skills were limited. Similarly, Santos and Villanueva (2022) reported that the effectiveness of teaching strategies depends heavily on alignment with learner needs and readiness, noting that strategies implemented without adequate scaffolding resulted in minimal gains in conceptual understanding. Recently, Lim and Bautista (2024) demonstrated that instructional strategies had little impact on learners' mathematics achievement unless combined with explicit feedback and guided practice.

Considering these findings, it can be deduced that other factors such as the learning gap, learning preferences or other instructional methods might have a greater influence on learners' mastery in quadratic equations and inequalities. Furthermore, integrating a combination of strategies may yield more meaningful improvements in student performance. A varied approach that balances explicit instruction, ICT-based tools, cooperative learning, and game-based activities may better address diverse learner needs and enhance both engagement and achievement. Ongoing assessment and feedback can further guide teachers in tailoring strategies to maximize learning outcomes.

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

Table 3.2. *Significant Relationship Between the Learners' Level of Mastery and the Extent of Use of Teaching Strategies in Quadratic Equations and Inequalities for Grade 9 Mathematics Learners in Terms of Cooperative Learning*

Variable	Level of Mastery in Quadratic Equations and Inequalities		
	Correlation Coefficient (r_s)	p-value	Remarks
Cooperative Learning	*-0.111*	*0.407*	Not Significant

Table 3.2 illustrates the relationship between the level of mastery and the extent of teaching strategies in terms of cooperative learning. The result shows a correlation coefficient (r_{xy}) of *-0.111* and a p-value of *0.407*, indicating no significant remark.

This finding is consistent with the study of Lopez and Manalo (2021), who reported that cooperative learning did not significantly improve mathematics achievement when group members had unequal levels of prior knowledge, leading to uneven participation. Similarly, Torres and Del Rosario (2022) found that cooperative learning activities only became effective when learners were provided with structured roles and guided facilitation; without these, students tended to rely on higher-performing peers, resulting in minimal individual learning gains. Additionally, Mendoza and Cruz (2023) emphasized that cooperative learning may fail to enhance mastery when the tasks require higher-order reasoning and students lack foundational conceptual understanding, as the group interaction does not automatically translate to deeper comprehension.

The lack of significant correlation suggests that cooperative learning may not be an effective strategy for enhancing students' understanding of quadratic equations and inequalities. This could also be due to various factors, such as the structure of the cooperative learning activities, the complexity of the topic, or the level of student engagement. It is also possible that cooperative learning requires careful planning and facilitation to be effective, and its success may depend on factors such as group dynamics, task design, and teacher guidance. Therefore, cooperative learning must be well-structured, scaffolded, and monitored to meaningfully contribute to improved mastery in mathematics.

Table 3.3. *Significant Relationship Between the Learners' Level of Mastery and the Extent of Use of Teaching Strategies in Quadratic Equations and Inequalities for Grade 9 Mathematics Learners in Terms of ICT-based Instruction*

Variable	Level of Mastery in Quadratic Equations and Inequalities		
	Correlation Coefficient (r_s)	p-value	Remarks
ICT-based Instruction	*-0.152*	*0.254*	Not Significant

Table 3.3 presents the relationship between learners' level of mastery and the extent of teaching strategies in quadratic equations and inequalities in terms of ICT-based instruction. The correlation coefficient (r_s) of *-0.152* and a p-value of *0.254* indicate no significant remark.

This result aligns with the study of Jimenez and Abad (2021), who found that while digital platforms and tools increased student engagement, they did not consistently translate into improved academic outcomes when learners lacked sufficient guidance and conceptual grounding. Similarly, Villaverde and Santos (2022) reported that ICT-based instruction tends to be less effective in mathematics when students face difficulties in self-regulated learning, particularly when tasks require multi-step reasoning. In addition, Ramos and Dizon (2023) emphasized that the effectiveness of ICT in mathematics instruction depends on structured teacher facilitation and scaffolding; without these, learners may focus more on navigating the technology rather than understanding the mathematical processes.

Moreover, the weak correlation could be attributed to factors such as the complexity of the technology used, lack of digital literacy among learners, or insufficient time allotted for ICT-based

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

activities. The effectiveness of ICT tools largely depends on how they are integrated into the teaching process rather than the mere presence of technology in the classroom. It is possible that the lack of significant relationship is due to the learners' preference for more traditional teaching methods when learning mathematical concepts. Additionally, the availability of technological resources and the teacher's competence in utilizing ICT tools might also impact the outcomes of ICT-based instruction. Therefore, the non-significant relationship observed in this study suggests that technology alone does not guarantee mastery unless paired with strong instructional support, guided practice, and conceptual clarification.

Table 3.4. *Significant Relationship Between the Learners' Level of Mastery and the Extent of Use of Teaching Strategies in Quadratic Equations and Inequalities for Grade 9 Mathematics Learners in Terms of Game-based Learning*

	Level of Mastery in Quadratic Equations and Inequalities		
Variable	Correlation Coefficient (r_{xy})	p-value	Remarks
Game-based Learning	*0.056*	*0.682*	Not Significant

Table 3.4 shows the relationship between the learners' level of mastery and the extent of use of teaching strategies in quadratic equations and inequalities in terms of game-based learning. The correlation coefficient (r_{xy}) of *0.056* and a p-value of *0.682* indicate a remark of not significant.

This finding is in line with the study of Navarro and Castillo (2021), who reported that game-based learning increased learner motivation and classroom engagement but did not consistently lead to improved test performance, particularly in lessons requiring abstract reasoning. Likewise, Ocampo and Javier (2022) found that game-based instructional approaches were more effective for recall and basic skills but had minimal impact on higher-order mathematical understanding without structured reflection and follow-up practice. Additionally, Fernandez and Lim (2023) emphasized that while learners enjoy interactive and competitive activities, the learning gains depend heavily on how the teacher connects the game logic to the conceptual development of the topic.

The weak and insignificant relationship can be inferred that game-based learning, while engaging, does not significantly influence learners' mastery of quadratic equations and inequalities. This result suggests that incorporating games into the classroom may not be enough to improve mastery without additional support or complementary instructional strategies. Thus, the non-significant relationship in this study suggests that game-based learning enhances motivation but does not automatically improve mastery unless paired with guided explanation and consolidation of ideas**.**

Developed Strategic Learning Intervention Package

Based on the results of the study, there are nine identified least mastered competencies under Quadratic Equations and Inequalities. The need to develop Strategic Learning Intervention Package is an utmost concern that may help address the identified learning gaps of Quadratic Equations and Inequalities. The learning intervention package was prepared to serve as a guide for both teachers and learners of Quadratic Equations and Inequalities of Mathematics 9 subject. The content of this package was based on the Most Essential Learning Competencies (MELCs) for Week 1-5 for first quarter of the Grade 9 Mathematics.

The developed Strategic Learning Intervention Package (SLIP) is a comprehensive resource designed to improve learners' mastery of quadratic equations and inequalities. It targets the nine least mastered competencies identified through the mastery test, grouped into: a) illustrating and solving quadratic equations, b) roots of quadratic equations, c) illustrating and solving quadratic inequalities, and d) solving problems involving quadratic equations and inequalities. The package includes PowerPoint presentations, learning guides, and teaching guides, all aligned to provide a cohesive instructional experience that

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

enhances understanding, engagement, and retention. A summative test at the end evaluates learners' mastery of the targeted competencies.

The developed Strategic Learning Intervention Package (SLIP) is a comprehensive, multi-component resource customized to improve learners' mastery of quadratic equations and inequalities. It focuses on the nine least mastered competencies identified through mastery test, ensuring targeted support for areas where learners struggle the most. The least mastered competencies are categorized into different topics under quadratic equations and inequalities: a) Illustrating and solving quadratic equations; b) Roots of Quadratic Equations; c) Illustrating and solving quadratic inequalities; and d) Solving problems involving quadratic equations and inequalities. The package includes three key components: power point presentations, learning guides, and teaching guides, all aligned to create a cohesive instructional experience and designed to enhance understanding, engagement, and retention. A summative test was included at the last part to evaluate the learners' mastery of competencies at the end of the lesson.

Power Point Presentations

The PowerPoint presentation is a key component of the Strategic Learning Intervention Package (SLIP) designed to address the nine identified least mastered competencies in quadratic equations and inequalities. This component is an instructional resource that visually and interactively presents mathematical concepts, making abstract ideas more accessible and engaging for learners. It serves as a tool for introducing the topics, which provide clear definitions, explanations and examples to help learners understand foundational concepts in quadratic equations and inequalities. Step-by-step problem-solving examples are included to demonstrate methods that guide learners through the process before they attempt independent practice. Questions and activities embedded within slides engage learners in active learning, allowing them to test their understanding during the lesson. Teachers can use the presentations as a framework for their lessons, ensuring consistency in content delivery while saving time on preparation.

The use of power point presentations enhances learners' comprehension by combining visual aids with structured explanations. The interactive nature fosters active engagement, which is critical for mastering complex mathematical topics like quadratic equations and inequalities. Additionally, each presentation has an easy access feature which provides a QR-code that can be scanned by the learners to easily access the presentations. This feature aims to bridge the gap between traditional and modern technology, making the content more accessible, engaging, and interactive for the learners. In summary, power point presentations play a vital role in bridging gaps in student understanding by delivering content in an engaging, accessible, and structured manner while supporting teaching in effective instruction.

Learning Guides

The learning guides are an integral part of the strategic learning intervention package which embodied the nine least mastered competencies in quadratic equations and inequalities. These guides serve as a self-directed resource for learners, enabling them to deepen their understanding of key concepts through sample problems, practice problem-solving and develop mastery through structured assessment.

The learning guides are tailored to meet the needs of individual learners by providing clear explanations, examples, and exercises that cater to varying levels of proficiency. It is also designed to guide students step-by-step from foundational concepts to more advanced applications, ensuring a gradual progression in understanding. These guides can be used independently for self-paced learning or collaboratively in group settings to encourage peer interaction and cooperative problem-solving. By offering structured support and engaging activities, the guides aim to enhance both understanding and retention of key concepts.

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

Teaching Guides

The teaching guides are vital part of the strategic learning intervention package that was designed to support teachers in delivering effective and structured instruction on quadratic equations and inequalities. The teaching guide serves as a roadmap for teachers, providing necessary details and procedures about the topic, key answers to practice problems and assessment to ensure the competencies are addressed comprehensively and efficiently. The teaching guide ensures that all lessons align with curriculum standards and learning objectives while addressing the specific gaps identified in student competencies.

Moreover, the teaching guide streamlines lesson delivery by outlining what to teach, how to facilitate discussions, guide problem-solving activities, and assess student progress. It promotes consistency across classrooms, ensures equitable learning opportunities, and reduces teachers' preparation time, allowing them to focus on engaging learners and addressing individual needs.

Summative Test

The inclusion of summative test in the strategic learning package serves as a critical tool for assessing learners' mastery of the nine least mastered competencies in quadratic equations and inequalities. The results of summative test help identify areas where learners may still struggle in order for the teachers to craft future interventions. It may also provide valuable insights to improve instruction and support learners' success.

Level of Validity of the Developed Strategic Learning Intervention Package

Identified evaluators who are Master Teacher in Mathematics, Professor in Mathematics, and an Education Program Supervisor in Mathematics assigned scores grounded from each set of indicators: adequacy, content, instructional quality, relevance and usability.

The data in Table 4.1 reveal the level of validity of the developed Strategic Learning Intervention Package (SLIP) in terms of Adequacy. The result shows a very high level of validity in terms of adequacy, as indicated by an overall mean of *4.83.* Each item received a rating above *4.80,* demonstrating that the package effectively explains and applies concepts, provides sufficient information, offers diverse practice problems, and presents adequate activities to enhance students' knowledge, skills, and attitudes. The highest-rated criterion, "provides expected outcome" with a mean of *4.90,* suggests that the package successfully meets its intended learning goals.

Table 4.1. *Level of Validity of the Developed Strategic Learning Intervention Package in Terms of Adequacy*

Items *The package…*	Mean	Description
1. explains and applies concepts and principles.	*4.85*	Very High
2. provides sufficient information on each topic.	*4.80*	Very High
3. provides enough activities to increase students' knowledge, skills, and attitudes.	*4.80*	Very High
4. offers a diverse collection of practice problems designed to be accessible to learners.	*4.80*	Very High
5. provides expected outcome.	*4.90*	Very High
Overall Mean	*4.83*	Very High

Based on the results, the package has potential in improving student performance because of its high ratings across all criteria. The findings imply that SLIP provides a clear, informative, well-designed, adequate, and varied interactive activities which allow learners to absorb mathematical concepts. Also, adequate exercises and practice problems promote conceptual understanding and mastery.

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

The alignment of intervention materials with curriculum objectives ensures they are suitable for learners' developmental levels, fostering creativity, innovation, and collaboration (Lazo & de Guzman, 2021). Likewise, Cabildo (2024) stresses the importance of adequate material development, validation, and alignment with curriculum objectives to ensure effectiveness in addressing learners' least mastered competencies. However, challenges such as limited resources and varying teacher capabilities in developing and utilizing these materials can hinder their effectiveness (Sadsad, 2022). Adequate and relevant materials are essential not only for addressing immediate learning gaps but also for preparing students for summative assessments and long-term academic success (Lazo & de Guzman, 2021; Sadsad, 2022). These studies imply that the learning package that aligns with curriculum objectives, provide clear, adequate information and varied activities will improve academic performance.

Table 4.2. *Level of Validity of the Developed Strategic Learning Intervention Package in Terms of Content*

Items *The package…*	Mean	Description
1. aligns with both the competencies and learning objectives set by the curriculum.	*4.50*	Very High
2. provides a clear connection between the topics, activities, and the intended learning outcomes.	*4.65*	Very High
3. presents facts, concepts, and processes that are accurate, current, and supported by credible sources.	*4.75*	Very High
4. promotes content that is inclusive and appreciative of diverse cultures.	*4.65*	Very High
5. integrates assessments that align with the learning objectives and activities.	*4.85*	Very High
Overall Mean	*4.68*	Very High

The data in Table 4.2 show the high level of validity of the Strategic Learning Intervention Package (SLIP) in terms of content, with an overall mean of *4.68*. All individual criterion also received a Very High rating, indicating that the package effectively aligns with curriculum competencies with *4.50*, connects topics and learning outcomes with *4.65*, presents accurate and credible content with *4.75*, promotes inclusivity with *4.65*, and integrates well-structured assessments with *4.85*. The highest-rated item, "integrates assessments that align with the learning objectives and activities" at *4.85*, suggests that the package is particularly strong in evaluating student learning through well-designed assessments. These findings validate the package's effectiveness in delivering structured, and inclusive content to support learners' learning. Furthermore, the consistently high ratings across all criteria indicate that the SLIP provides a balanced and well-rounded approach to instruction, ensuring that all essential aspects of effective teaching are incorporated.

The very high validity ratings suggest that the SLIP is a well-structured instructional material that ensures alignment with curriculum standards and enhances learning through accurate, inclusive, and well-connected content. The emphasis on assessments suggests that evaluators find the package effective in measuring student progress and reinforcing learning objectives. In addition, the content is well-presented and aligned with the existing curriculum of the Department of Education. These aspects contribute to the material's ability to foster meaningful learning experiences, as learners are exposed to structured lessons that build upon their prior knowledge. Moreover, the high validity of the package implies that it can be a useful tool for both teachers and learners, helping to streamline instructional delivery and promote mastery of concepts.

Research on the validation of Strategic Intervention Materials (SIMs) highlights that content plays a pivotal role in ensuring their appropriateness, clarity, and relevance. For instance, a study on SIMs for Trigonometry found that the materials were rated as Excellent by content validators, particularly in terms

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

of readability, importance of content, and alignment with learning objectives, achieving an overall mean of *4.75* out of *5.00* (Luzano, 2020). Integrating higher-order thinking skills, such as critical thinking and problem-solving, also improves long-term learning and performance (Villaran et al., 2024). These findings emphasize the importance of well-designed content in addressing learning gaps, strengthening engagement, and building student confidence. Thus, validating content remains essential to ensure SIMs lead to meaningful and lasting learning outcomes.

Table 4.3. *Level of Validity of the Developed Strategic Learning Intervention Package in Terms of Instructional Quality*

Items *The package…*	Mean	Description
1. outlines learning objectives that are clearly stated and measurable.	*4.70*	Very High
2. arranges lessons and activities in a progressive order to support effective learning.	*4.55*	Very High
3. features interactive and stimulating activities that encourage learners' engagement.	*4.85*	Very High
4. showcases a visually balanced design, featuring a clear layout and appropriate use of graphics, colors, and fonts.	*4.45*	Very High
5. guides learners through a structured process and gradually building on their prior knowledge.	*4.70*	Very High
Overall Mean	*4.65*	Very High

Table 4.3 presents the level of validity of the developed strategic learning intervention package in terms of instructional quality. The results show that the SLIP has a very high level of validity in terms of instructional quality with an overall mean of *4.65*. The package effectively outlines clear and measurable learning objectives at *4.70*, arranges lessons progressively at *4.55*, provides interactive and engaging activities at *4.85*, maintains a visually appealing design at *4.45*, and supports structured learning at *4.70*.

Item 3 received the highest rating of *4.85*, "features interactive and stimulating activities that encourage learners' engagement", while item 2 got the lowest rating of *4.55*. These results imply that the package portrayed quality in making learning dynamic and engaging. Its organized approach allows learners to build their prior knowledge and the visually appealing design also adds in keeping student's interest and attention. The overall validation suggests that the instructional quality of the package contributed to the effectiveness in delivering a well-organized and engaging learning experiences.

In the study of Yu and Chen (2023), they discovered that interactive and structured learning materials significantly improve student engagement and comprehension. Howard and Whitmore (2020) also found that visual appeal, along with engaging writing and clarity, significantly influences students' desire to use educational materials. Additionally, the study of Amos et al. (2022) concluded that a good presentation of a lesson has a substantial impact on teaching and learning situations. Based on these studies, the SLIP possesses a well-designed and engaging learning tools that effectively enhances instructional quality.

Table 4.4. *Level of Validity of the Developed Strategic Learning Intervention Package in Terms of Relevance*

Items *The package…*	Mean	Description
1. incorporates examples and scenarios that align with the learners' environment and lived experiences.	*4.45*	Very High
2. provides resources that are designed to meet the diverse learning styles, needs, and paces of learners.	*4.30*	Very High

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

3.	presents activities that encourage active student participation and enhance critical thinking.	*4.65*	Very High
4.	incorporates formative and summative assessments that effectively measure students' understanding and progress.	*4.35*	Very High
5.	addresses specific identified learning deficits.	*4.65*	Very High
Overall Mean		*4.48*	Very High

Table 4.4 presents the level of validity of the developed strategic learning intervention package in terms of relevance. The result shows that the SLIP is highly valid with an overall mean of *4.48*. The package aligns well with student environments with *4.45*, meets diverse learning needs at *4.30*, encourages participation and critical thinking at *4.65*, includes assessments at *4.35*, and addresses learning deficits at *4.65*. The package is highly relevant to learners' educational contexts and individual learning needs, though catering to diverse learning styles at *4.30* could be improved.

The very high ratings across most items indicate that the SLIP effectively connects with students' real-world experiences and learning needs. The package promotes active participation and fosters critical thinking, which are vital for deeper learning and skill development. While the content is pertinent and addresses significant learning gaps, further refinement of resources to better accommodate diverse learning styles could improve its inclusivity. This would ensure that all learners, regardless of their preferred learning methods, are fully engaged and can benefit from the materials.

Recent studies emphasize the critical role of relevance in developing effective intervention materials, as it ensures alignment with learners' needs and enhances engagement and learning outcomes. Research on competency-based strategic intervention materials (SIM) highlights those materials tailored to learners' least mastered skills significantly improve their performance, with post-test scores showing marked improvements over pre-test results (Sinco, 2020). Similarly, the development of contextualized strategic intervention materials (CSIMs) for marine ecosystems underscores the importance of incorporating real-world examples and culturally relevant content to make complex subjects more accessible and engaging (Rameri et al., 2025). Studies also reveal that interactive and visually appealing materials, such as infographics and digital resources, significantly enhance students' understanding and retention of challenging topics (Rameri et al., 2025; Manlapig et al., 2024). These findings collectively demonstrate that relevance in intervention materials like SLIP is essential for fostering effective learning and addressing specific educational gaps.

Table 4.5. *Level of Validity of the Developed Strategic Learning Intervention Package in Terms of Usability*

Items *The package…*		Mean	Description
1.	ensures ease of use for both teachers and learners.	*4.50*	Very High
2.	delivers instructions that are simple, clear, and easy to comprehend.	*4.40*	Very High
3.	provides flexibility to modify its components for different classroom needs.	*4.70*	Very High
4.	offers content that corresponds with the learners' academic level and cognitive growth.	*4.40*	Very High
5.	presents concise and easy-to-understand directions for activities and assessments.	*4.60*	Very High
Overall Mean		*4.52*	Very High

Table 4.5 presents the level of validity of the developed Strategic Learning Intervention Package (SLIP) in terms of its usability. The results show that the SLIP has high usability with an overall mean of *4.52*. The ability to ensure ease of use for both teachers and learners got *4.50*, provides simple and clear

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

instructions at *4.40*, provides flexible modifications at *4.70*, aligns with learners' academic levels at *4.40* and has easy to follow activity directions at *4.60*.

Based on the high ratings, the package is a user-friendly educational resource that improves the teaching and learning process. It features digital access of learners through a QR-code, that enables learners to access the materials easily. Additionally, learners' cognitive burden is reduced by the package's clarity and ease of use, allowing them to concentrate on comprehension rather than figuring out instructions. Even though the usability has been thoroughly tested, it might still be made more accessible, especially for learners with different skill levels, by improving the instructional clarity and content alignment with cognitive development.

Recent studies emphasize the critical role of usability in developing effective learning intervention materials. The study of Alghabban and Hendley (2022) on adaptive e-learning systems for dyslexic children demonstrated a positive correlation between perceived usability and learning performance. The study revealed that when materials are adapted to learners' needs, usability enhances engagement and motivation, leading to better academic outcomes. Another study by Zi et al. (2020) highlighted the importance of tailoring educational technologies to specific learner populations, showing that usability adjustments improve accessibility and inclusivity for adolescents on the autism spectrums. Collectively, these findings underscore that prioritizing usability in learning intervention materials not only improves user experience but also broadens accessibility and supports diverse learners needs.

Table 4.6. *Summary Result on the Level of Validity of the Developed Strategic Learning Intervention Package*

Indicators	Mean	Description
1. Adequacy	*4.83*	Very High
2. Content	*4.68*	Very High
3. Instructional Quality	*4.65*	Very High
4. Relevance	*4.48*	Very High
5. Usability	*4.52*	Very High
Overall Mean	*4.63*	Very High

Table 4.6 presents the level of validity of the developed Strategic Learning Intervention Package based on five essential criteria which is adequacy, content, instructional quality, relevance and usability. Adequacy received the highest mean of *4.83* out of all other categories followed by content with a mean of *4.68*. On the other hand, relevance got a lowest rating of *4.48* and usability at *4.52*. Instructional quality got the nearest rating of *4.65* to the overall mean of *4.63*.

Given these data, the overall description of Very High clearly indicates that the package effectively meets key educational standards, making it a trustworthy tool for enhancing learners' learning. The adequate information, organized content, quality of instruction, relevant information, and usability factor of the package makes it a valuable resource for both teachers and learners. The high ratings offer enough strengths of the package while lower scores indicate opportunities for enhancement in aligning the package more closely to learners' real-world experiences and ensuring it is user-friendly.

Integration of Theory with the Findings of the Study

The findings of the study align with Piaget's (1986) Cognitive Development Theory and Constructivist Learning Theory, as they emphasize the active role of learners in constructing knowledge through experience and interaction. Teaching strategies like explicit instruction, cooperative learning, ICT-based instruction, and game-based learning promote learning engagement, critical thinking, and the construction of meaningful knowledge. The insignificant relationship of these strategies to the mastery level

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

of the learners implies that it has a minimal effect and does not directly impact students understanding. Other factors such as learning content, learning styles, learning methods and resources have greater influence to the learner's mastery and overall mathematics experience.

Findings

Based on the results of the study, the following are the summary of findings:

1. Level of Mastery in Quadratic Equations and Inequalities of Grade 9 Mathematics Learners
   - 1.1. The level of mastery of grade 9 learners in Illustrating and Solving Quadratic Equations is Moderately High with an overall mean score of *42.99%.*
   - 1.2. The level of mastery of grade 9 learners in Roots of Quadratic Equations is Low with an overall mean score of *31.32%.*
   - 1.3. The level of mastery of grade 9 learners in Illustrating and Solving Quadratic Inequalities is Low with an overall mean score of *27.20%.*
   - 1.4. The level of mastery of grade 9 learners in Solving Problems Involving Quadratic Equations and Quadratic Inequalities is Low with an overall mean score of *26.23%.*
   - 1.5. Generally, the level of mastery of grade 9 learners in Quadratic Equations and Inequalities is described as Low with an overall mean score of *32.66%.* All competencies described as Low is identified as least mastered competencies.
2. Extent of Teachers' Use of Teaching Strategies in Quadratic Equations and Inequalities
   - 2.1. The extent of teachers' use of teaching strategies in quadratic equations and inequalities in terms of Explicit Instruction obtained an overall mean of *4.64* described as Always.
   - 2.2. The extent of teacher's use of teaching strategies used in quadratic equations and inequalities in terms of Cooperative Learning obtained an overall mean of described as Often.
   - 2.3. The extent of teacher's use of teaching strategies in quadratic equations and inequalities in terms of ICT-based Instruction obtained an overall mean of *4.61* described as Always.
   - 2.4. The extent of teacher's use of teaching strategies in quadratic equations and inequalities in terms of Game-based Learning obtained an overall mean of *3.93* described as Often.
   - 2.5. Generally, the extent of teachers' use of teaching strategies in quadratic equations and inequalities indicates that these strategies as being implemented Always with overall mean of *4.30*.
3. Significant Relationship Between the Learners' Level of Mastery and the Extent of Teaching Strategies
   - 3.1. There is no significant relationship between the Learners' Level of Mastery and the extent of teachers' strategy used in teaching Quadratic Equations and Inequalities in Grade 9 Mathematics in terms of Explicit Instruction.
   - 3.2. There is no significant relationship between the Learners' Level of Mastery and the extent of teachers' strategy used in teaching Quadratic Equations and Inequalities in Grade 9 Mathematics in terms of Cooperative Learning.
   - 3.3 . There is no significant relationship between the Learners' Level of Mastery and the extent of teachers' strategy used in teaching Quadratic Equations and Inequalities in Grade 9 Mathematics in terms of ICT-based Instruction.
   - 3.4 . There is no significant relationship between the Learners' Level of Mastery and the extent of teachers' strategy used in teaching Quadratic Equations and Inequalities in Grade 9 Mathematics in terms of Game-based Learning.
4. Strategic Learning Intervention Package

   The Developed Strategic Learning Intervention Package was developed to address learning gaps in Quadratic Equations and Inequalities for grade 9 learners. It consists of

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interactive PowerPoint presentations, learning and teaching guides, activity sheets, practice tests, and a summative test, all aligned with the Most Essential Learning Competencies (MELCs) for the first quarter. This package covers four essential topics: 1) Illustrating and Solving Quadratic Equations, 2) Roots of Quadratic Equations, 3) Illustrating and Solving Quadratic Inequalities, and 4) Solving Problems Involving Quadratic Equations and Inequalities.

5. Validity Level of Developed Strategic Learning Intervention Package
    - 5.1. The validity level of the developed strategic learning intervention package in terms of Adequacy is Very High with a mean of *4.83*.
    - 5.2. The validity level of the developed strategic learning intervention package in terms of Content is Very High with a mean of *4.68*.
    - 5.3. The validity level of the developed strategic learning intervention package in terms of Instructional Quality is Very High with a mean of *4.65*.
    - 5.4. The validity level of the developed strategic learning intervention package in terms of Relevance is Very High with a mean of *4.48*.
    - 5.5. The validity level of the developed strategic learning intervention package in terms of Usability is Very High with a mean of *4.52*.
    - 5.6. Generally, the validity level of the developed strategic learning intervention package is Very High with an overall mean of *4.63*. The high level of validity implies that the developed SLIP followed necessary requirements and standards.

CONCLUSIONS

The study's findings led to the following conclusions:

1. The grade 9 learners a\re struggling with the following identified nine competencies: solves quadratic equations by factoring; solves quadratic equations by using the quadratic formula; characterizes the roots of a quadratic equation using the discriminant; describes the relationship between coefficients and the roots of a quadratic equation; solves equations transformable to quadratic equations; illustrates quadratic inequalities; solves quadratic inequalities; solves problems involving quadratic equations and rational algebraic equations; and solves problems involving quadratic inequalities. This highlights the need for targeted instructional strategies and supportive learning materials to help students master these concepts.
2. Teachers consistently utilized instructional strategies like explicit instruction and ICT-based instruction while cooperative learning and game-based learning were often used.
3. Statistical analysis showed no significant relationship between the learners' level of mastery and the extent of teaching strategies employed in terms of explicit instruction, cooperative learning, ICT-based instruction, and game-based learning, indicating that other factors may influence student performance in quadratic equations and inequalities.
4. To address the identified learning gaps, a Strategic Learning Intervention Package was developed.
5. The strategic learning intervention package was evaluated as highly valid in terms of adequacy, content, instructional quality, relevance, and usability, making it a suitable tool for enhancing student learning. The findings indicate that although current teaching strategies are being used, further interventions like the newly developed learning package may be essential for effective enhancement of learners' mastery in quadratic equations and inequalities. The evaluators' suggestions and recommendations serve a valuable opportunity to improve the package.

Implementing these recommendations can further ensure the package effectively addresses learners' difficulties and promotes deeper understanding.

Recommendations

The following recommendations are being proposed based on the findings and conclusions of the study.

1. The developed Strategic Learning Intervention Package may be adopted and integrated into the teaching of Quadratic Equations and Inequalities to supplement existing instructional strategies.
2. Regular assessment of learners' learning may be conducted to identify persistent gaps and areas for improvement.
3. Feedback from both teachers and learners may be gathered to refine and enhance the learning intervention package.
4. Teachers may explore additional strategies beyond explicit instruction, cooperative learning, ICT-based instruction, and game-based learning to improve students' mastery of Quadratic Equations and Inequalities. Also, teachers may intensify the use of cooperative learning and game-based learning to further maximize the effect to teaching-learning process.
5. Comparative studies may be conducted to evaluate the effectiveness of the learning intervention package in different learning environments.
6. Future studies may explore additional factors affecting student mastery in Quadratic Equations and Inequalities, such as student motivation, learning styles, and external influences.

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