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Examining self-confidence and problem-solving strategies as catalysts for Mathematics performance in a Philippine Grade 10 classroom

Angela Rose M. Mijares*
Cebu Technological University-Main Campus, Cebu City, Cebu, Philippines

John Jefferson L. Revalde
Cebu Technological University-Main Campus, Cebu City, Cebu, Philippines

Zaira Marie C. Manulat
Cebu Technological University-Main Campus, Cebu City, Cebu, Philippines

Mark Ryan L. Otida
Cebu Technological University-Main Campus, Cebu City, Cebu, Philippines

Aiah M. Mijares
Cebu Technological University-Main Campus, Cebu City, Cebu, Philippines

ABSTRACT

This study sought to determine the relationship among self-confidence in learning higher mathematics, problem-solving strategies, and mathematics performance of the Grade 10 students in a public secondary school in Barili, Cebu for the school year 2025–2026 as a basis for a suitable action plan employing a quantitative descriptive-correlational research design. There was a total of 66 Grade 10 students who participated in the study utilizing complete enumeration technique. The data gathered were treated using frequency count, simple percentage, weighted mean, Pearson r and Spearman rho. The results revealed that the respondents' level of self-confidence in learning higher mathematics was evidently at a low level in almost all indicators. Their level of mathematical problem-solving strategies was measured using Polya's three stages: identifying and analyzing the problem, selecting appropriate solution methods and checking and evaluating the final answer. Each of the three stages obtained a Fair verbal description, resulting to an overall verbal description "Fair" with a grand mean of 2.45 and a grand standard deviation of 0.83. For the level of mathematics performance, 22.73% of the respondents were on an outstanding level, 18.18% fell on the very satisfactory level, 24.24% were on a satisfactory level, 31.82% on the fairly satisfactory level and only 3.03% of the respondents did not meet the expectations concerning their mathematics performance. The test of relationship between self-confidence and mathematical problem-solving strategies revealed that there is a moderate positive correlation, while weak positive correlation exists between self-confidence and mathematics performance as well as between problem-solving strategies and mathematics performance. It is concluded that while

*Corresponding author / Email: angelarosemijares@gmail.com
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respondents exhibit a moderate level of proficiency in mathematical problem-solving strategies and generally attain satisfactory academic performance, significant gaps persist in their higher-order thinking skills, consistency of achievement, and self-confidence in learning mathematics. Hence, it is recommended that the action plan crafted called SPARK Plan be utilized.

Keywords: Teaching Mathematics, self-confidence, mathematical problem solving strategies, academic performance, quantitative descriptive-correlational research design, Barili, Cebu, Philippines.

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INTRODUCTION

Mathematics is widely recognized as a foundational discipline that supports scientific, technological, and economic advancement in the 21st century. According to Wanamaker (2024), the rapid evolution of global economies demands a citizenry that is mathematically literate and capable of complex problem-solving of which is also backed by the result of the study of Kappassova et.al. (2025). The performance of students in higher mathematics is often seen as a reflection of their readiness to engage in higher-order thinking and problem-solving. Thus, assessing Grade 10 student's mathematics performance, self-confidence in learning higher mathematics, and their mathematical problem-solving strategies is crucial in understanding their preparedness for Senior High School (SHS) and beyond.

Self-confidence reflects the learner's psychological assurance that they can effectively learn and apply mathematical concepts in higher mathematics. Self-confidence plays a crucial role in readiness as Nicolas and Calibo (2024) says that students who believe in their ability to succeed are more likely to engage actively, persist in solving problems, and overcome challenges. Mathematical problem-solving strategies, on the other hand, are systematic approaches students employ to identify and analyze the problem, to select appropriate solution methods, and to assess the answer, which directly affect their performance outcomes (Morata, 2024). These definitions show the interconnectedness of performance, self-confidence, and the problem-solving strategies in mathematics education.

Self-confidence significantly influences how students approach mathematical problem-solving and, in turn, affects their overall performance. Learners with strong self-confidence are more likely to engage actively with challenging tasks, explore multiple strategies, and persist despite difficulties. Wahyuni et al. (2024) found that self-confidence reduces math anxiety and enhances students' ability to solve problems effectively. Similarly, Zakariya (2022) demonstrated that interventions aimed at strengthening mathematics self-efficacy led to measurable improvements in achievement, underscoring confidence as a determinant of success. Montablan et al. (2024) further revealed that high school learners with greater self-efficacy performed better even in real-world mathematical contexts, highlighting the link between confidence and proficiency. Collectively, these findings suggest that fostering self-confidence is not merely motivational but a critical factor in shaping students' problem-solving strategies and their ultimate performance in mathematics.

This study is firmly anchored in both global and national education priorities. At the international level, it contributes to the United Nations Sustainable Development Goal (UNSDG) 4: Quality Education, which calls for inclusive and equitable quality education and the promotion of lifelong learning opportunities for all (United Nations, 2015). Within the Philippine context, it supports the Department of Education's Basic Education Development

Plan (BEDP) 2030, which emphasizes strengthening the K to 12 curriculum, enhancing learner readiness, and improving learning outcomes in mathematics (Department of Education, 2022). By focusing on Grade 10 students' mathematics performance, self-confidence, and problem-solving strategies, this research directly addresses DepEd's agenda of preparing learners for Senior High School and ensuring mastery of foundational skills critical for STEM pathways.

Learning mathematics involves the interaction of readiness, instructional strategies, and assessment systems. According to Narud (2021), students with higher readiness level tend to adapt more effectively to problem-solving tasks, while those with gaps struggle with comprehension and application. Teachers have a great effect in scaffolding these processes by providing interventions that address prerequisite competencies and improve problem-solving skills (Cayabyab, 2023). This dynamic system reinforces the need for continuous monitoring of readiness and performance.

Globally, mathematics performance among secondary school students presents a mixed picture. According to the Programme for International Student Assessment (PISA) 2022 results, the average mathematics score among Organisation for Economic Co-operation and Development (OECD) countries dropped to 485, the lowest since PISA's inception in 2000, indicating a widespread decline in mathematical competencies (OECD, 2023). In the Philippines, where this study is contextualized, the Philippine Statistics Authority (PSA) reported that only 57% of Grade 10 students met the minimum proficiency level in mathematics based on the 2018 National Achievement Test (NAT) results (DepEd, 2019).

Locally, regional assessments in various provinces have shown consistent weaknesses in areas such as algebraic reasoning, geometric visualization, and statistical literacy (DepEd, 2025). Compounding this issue is the disruption caused by the COVID-19 pandemic, which exacerbated learning losses, particularly in subjects requiring systematic skill-building like mathematics. The Department of Education noted a significant decline in student engagement and mastery during remote learning periods, with mathematics identified as one of the most affected subjects (Meniano & Tan, 2022; Layar et al., 2021). These data underscore a pressing need to diagnose not only the extent of underperformance but also the underlying cognitive and metacognitive factors that influence students' ability to tackle mathematical problems. This declining trend has been of grave concern as many students are unable to gain entry to the Senior High School level due to low grades they obtained in mathematics (Amoah, 2024).

Although Mathematics is undeniably important, large numbers of students encounter various obstacles and challenges in fully grasping its learning competencies. One concrete example is a study conducted by the Mathematical Society of Japan, it disclosed that while students are generally able to use standard mathematical formulas, they often find it difficult to articulate the reasoning behind their answers (Apelo & Arcenas, 2024). Evidence shows that students in Grades 10 and 11 face difficulties as they transition from junior high to senior high school. Herrera and Dio (2016) reported that incoming Grade 11 students in the Division of Sorsogon, Philippines were only moderately prepared, achieving an MPS of just 40 percent on a 50-item test assessing the prerequisite competencies for General Mathematics. Grade 10 learners are not equipped with the abilities and skills needed to comprehend the ideas taught in Senior High School General Mathematics (Narud, 2021).

According to Granada and Bacus (2025), this issue has been widespread across the different regions in the country, particularly in one of the public schools in Mandaue City, Cebu, Philippines, wherein students are relatively having poor performance in Math. Due to this, many students tend to choose other academic strands than STEM since it is primarily viewed that STEM subjects pose significant challenges, particularly mathematics-related subjects. The same circumstance arises in many secondary schools in the Province of Cebu.

The prerequisite nature of many subjects, combined with low academic performance and low interest in Mathematics poses a vital concern.

As a public-school teacher in assigned in Barili, Cebu, I have a fair share of experience teaching Mathematics to Grade 10 learners, most students hesitate to engage with complex mathematical problems due to low self-confidence especially during oral recitations and board works, only a few to none of them who bravely raises their hand to answer a math problem or question for the reason that they doubt their answers and afraid they might commit mistakes instead of taking the risk to try and learn from it. This classroom reality is reinforced by the Rapid Math Assessment (RMA), a national tool created by DepEd to measure Junior High School proficiency, which revealed that 68% of Grade 10 learners at my school fall under the "Emerging (Not Proficient)" category and 32% of the entire Grade 10 population fall under the "Emerging (Low Proficient)" category. The result of this assessment is certainly concerning since it shows that cumulative learning gaps from Grades 7, 8, and 9 have carried over and intensified, leaving learners unprepared for higher mathematics. These statistics confirm what I encounter daily such as weaknesses in foundational skills and self-confidence ultimately culminate in Grade 10 learners being unable to cope with the demands of Senior High School mathematics. This personal experience, aligned with local evidence, underscores the urgent need for effective interventions that strengthen both competence and self-confidence early on.

Although numerous studies have explored mathematics readiness, self-confidence, and problem-solving strategies, there remains a contextual gap and a relationship gap in the literature, as defined by Miles (2017). A contextual gap exists when research has not been conducted in a specific environment or population, and in this case, few studies have examined these variables within Cebu Province, but not particularly in Barili. Meanwhile, a relationship gap arises when the interaction among variables has not been sufficiently investigated. While prior research has separately analyzed mathematics performance, self-confidence, and problem-solving strategies, their combined influence on Grade 10 learners' readiness for Senior High School remains unexplored in this locale. Addressing these gaps is crucial, as it provides localized evidence that can inform targeted interventions and contribute to both national educational planning and the global discourse on mathematics education.

This study is firmly anchored in both global and national education priorities. At the international level, it contributes to the United Nations Sustainable Development Goal (UNSDG) 4: Quality Education, which calls for inclusive and equitable quality education and the promotion of lifelong learning opportunities for all (United Nations, 2015). Within the Philippine context, it supports the DepEd's Basic Education Development Plan (BEDP) 2030, which emphasizes strengthening the K to 12 curriculum, enhancing learner readiness, and improving learning outcomes in mathematics (DepEd, 2022).

Overall, the discussed local, national, and international declines in math competency underscore how urgent it is to address students' preparedness for senior high school higher mathematics. As a math teacher, the researcher has seen firsthand how several students suffer with poor self-confidence, fear of making mistakes, and difficulties completing mathematical problems, all of which have a detrimental impact on their performance. These experiences, which are supported by the Rapid Math Assessment (RMA) results, highlight the significance of analyzing Grade 10 students' mathematical performance, self-confidence, and problem-solving techniques. Learning gaps that can impede their transition to senior high school can be found by evaluating these factors. Conducting this study in a Public National High School in Barili, Cebu for the school year 2025-2026 will be very vital to provide basis for proposing appropriate action plan.

Statement of the problem

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This study determined the relationship among self confidence in learning higher mathematics, problem solving strategies, and mathematics performance of Grade 10 students in one of the Public Secondary Schools in Barili, Cebu, for the school year 2025–2026 as a basis for a suitable action plan.

Specifically, this study sought to answer the following questions:

1. What is the level of the respondents' self confidence in learning higher Mathematics?
2. What is the level of the respondents' mathematical problem solving strategies in terms of identifying and analyzing the problem, selecting appropriate solution methods, and checking and evaluating the final answer?
3. What is the level of mathematics performance of the respondents?
4. Is there a significant relationship between the respondents' self confidence in learning higher Mathematics and their mathematical problem solving strategies?
5. Is there a significant relationship between the respondents' self confidence in learning higher Mathematics and their mathematics performance?
6. Is there a significant relationship between the respondents' mathematical problem solving strategies and their mathematics performance?
7. Based on the findings, what action plan may be proposed?

METHODOLOGY

The study employed a quantitative descriptive-correlational design, which, according to McCombes (2022), is used to describe characteristics of a population and analyze associations among variables without manipulation. Consistent with Creswell and Creswell (2018), who explain that quantitative research is appropriate for measuring variables and testing relationships, this study formulated research questions and null hypotheses to examine whether self-confidence and problem-solving strategies are significantly related to mathematics performance. The use of this design was highly appropriate because the study aimed not only to describe the current proficiency levels of Grade 10 learners but also to determine whether their self-confidence and problem-solving strategies are statistically related to mathematics performance. As Creswell and Creswell (2018) emphasize, correlational designs are particularly useful when the goal is to identify associations among constructs in natural settings, while McCombes (2022) notes that descriptive-correlational studies are effective in educational contexts where the researcher seeks to capture population characteristics and variable relationships. Since the research problem involved readiness for Senior High School mathematics, this design ensured methodological rigor while remaining aligned with the study's objectives.

The population consisted of Grade 10 students in a public secondary school in the Division of Cebu Province, particularly in Barili, Cebu, and the respondents were all the Grade 10 students since this study utilized the complete enumeration technique. Ethical considerations, including informed consent, confidentiality, and voluntary participation, were strictly observed in accordance with standard research protocols. Data were collected through an adapted questionnaire, which is in line with Bhandari's (2022) recommendation that surveys and structured instruments are appropriate tools in quantitative research. Statistical treatment included descriptive statistics for profiling, weighted means to determine levels, and Pearson's r and Spearman's rho to analyze relationships, consistent with the analytical procedures typical of correlational studies (Creswell & Creswell, 2018). The research followed a realistic timeline comprising instrument development, data collection, data analysis, and report writing. While

the design allowed exploration of relationships among variables, limitations, such as reliance on self-reported readiness and a focus on a selected school in the Province of Cebu, may limit generalizability. Despite these constraints, the study maintained high methodological rigor to generate meaningful findings and inform a proposed action plan for improving mathematics education.

To present the logical sequence of the investigation, the study followed the Input–Process–Output (IPO) model, as illustrated in the figure showing the flow of the study. This framework illustrated how the necessary data were gathered, analyzed, and ultimately transformed into meaningful recommendations for improving mathematics education. The input phase involved gathering essential information from respondents, including their mathematics performance, self-confidence in learning higher mathematics, and the levels of mathematical problem-solving strategies. The respondents' mathematical performances were retrieved from the Grade 10 mathematics subject teachers. These inputs provided the foundational data necessary to understand the characteristics of the participants and the variables being examined. The process phase consisted of administering survey questionnaires to the respondents. The collected data were then organized, tabulated, and subjected to appropriate statistical analyses, such as descriptive statistics and correlation tests, to interpret the results and answer the research questions. The output phase resulted in the development of a proposed action plan based on the study's findings. The action plan aims to enhance students' readiness, strengthen their problem-solving abilities, and improve their overall mathematics performance, serving as practical recommendations for educational improvement.

The study was conducted in one of the public secondary schools in the Municipality of Barili, Cebu, particularly in Barangay Giloctog, as shown in the location map of the research environment. The school serves approximately 300 students and is staffed by 16 teaching and 4 non-teaching personnel. This school setting provides a suitable environment for investigating the relationship among strategic problem-solving skills, self-confidence, and mathematics performance of Grade 10 students. As a medium-sized public secondary school, it reflects the typical learning conditions experienced by many learners in rural and semi-rural areas of the division. The availability of educational facilities such as the library and computer laboratory supports learning opportunities that may contribute to the development of students' problem-solving abilities and academic achievement in mathematics. Moreover, the Grade 10 students in this setting represent a population facing various mathematical learning challenges and opportunities, making them appropriate participants for examining how self-confidence, strategic problem-solving skills, and mathematics performance influence each other. The school context allows for the assessment of these variables within an actual classroom environment where students regularly engage in mathematical tasks, problem-solving activities, and performance assessments. Consequently, the findings of the study may provide valuable insights into improving mathematics instruction and enhancing students' confidence and problem-solving competencies in similar public secondary school settings.

The Grade 10 students enrolled in a secondary school in Barili, Cebu during the 2025–2026 academic year, who were divided into two sections, served as the respondents of the study. The study utilized the complete enumeration technique, wherein all members of the identified population were included as respondents. Complete enumeration was employed to ensure comprehensive data collection and to obtain accurate and reliable results since the entire population was accessible. This technique was appropriate for the study because the Grade 10 population was relatively small and manageable, allowing the researcher to gather data from all students and obtain a complete representation of their strategic problem-solving skills, self-confidence, and mathematics performance. Students in Grade 10 were selected because they are in their last year of junior high school and are anticipated to have already mastered the

problem-solving techniques, self-confidence, and mathematical performance indicators that this study seeks to evaluate. They are trustworthy sources of information about their performance levels and preparedness since they actively participate in mathematics education. The distribution of the respondents in the two sections is presented in Table 1, which showed that the total number of respondents was 66 Grade 10 students from the two sections. Grade 10 Amethyst contributed 33 students (50.00%) and Grade 10 Gold also contributed 33 students (50.00%), for a total of 66 (100%). This equal distribution ensured that both sections in Grade 10 were fairly represented in the assessment of students' mathematics performance, self-confidence, and problem-solving strategies. The balanced sample supported a more accurate comparison and provided comprehensive insights into the learners' competencies across the two sections.

To gather the information needed to evaluate the mathematics performance, self-confidence in learning higher mathematics, and problem-solving techniques of Grade 10 students in a public secondary school in Barili, Cebu for the School Year 2025–2026, the study utilized an adapted survey questionnaire as the main research tool. After adaptation, the questionnaire was subjected to validation to ensure clarity, relevance, and appropriateness in collecting precise data pertinent to the variables mentioned in the problem statement and to directly correspond with the goals of the investigation. The instruments used in this study are provided in the appendices section. The survey questionnaire for students consisted of two major parts, each addressing a specific component of the study. Part I measured self-confidence in learning higher mathematics. The self-confidence in learning mathematics instrument, originally developed by Moneva (2020), was employed in this study to measure students' confidence levels in engaging with higher mathematics. The instrument was adapted from Moneva's (2020) research, and formal permission to use it would be requested through email communication with the original author. Once approval was secured, responses would be collected from the identified Grade 10 respondent groups to generate data relevant to the study's objectives. Part II measured the level of mathematical problem-solving strategies, which was developed from the research of Gurat (2018). The identified strategies were used to construct a framework of metacognitive strategy knowledge in solving math problems. For validity and reliability of the research instrument, it was adapted from the research of Gurat (2018). Through email communication, the researchers requested permission to use the said instrument, which was answered by the respondent groups. The items in Part 1 were measured using a four-point Likert scale with responses ranging from 1 as strongly disagree, 2 as disagree, 3 as agree, and 4 as strongly agree, adapted from the survey questionnaire of the study of Moneva (2020). Part 2 was likewise measured using a four-point Likert scale with responses ranging from 1 as never or only rarely true of me, 2 as sometimes true of me, 3 as frequently true of me, and 4 as always or almost always true of me, which is an instrument adapted from the research of Gurat (2018). The mathematics performance of the respondents was assessed using the third quarter mathematics grades retrieved with the help of the Grade 10 mathematics subject teachers, given that all the required permissions and communications were established.

The data gathering procedure began with a preliminary stage in which the researcher wrote a letter addressed to the Schools Division Superintendent of Cebu Province. The letter was personally handed over to the school principal of the research environment to inform her about the researcher's objective. For proper channeling, the school principal drafted the First Indorsement on her end and forwarded the papers to the District Supervisor for Second Indorsement, after which they were forwarded to the Division Office for approval together with the approved permit to study documents. After the approval of the letter by the Schools Division Superintendent, the researcher set up a meeting with the school principal and advisory

class teachers regarding the conduct of the survey. In the data gathering stage, on the scheduled day, the researcher conducted an orientation regarding the study. The study's purpose, methodology, and respondent confidentiality were among the crucial subjects discussed. The assent form and survey questionnaires were distributed after the orientation. The respondents signed their individual copies of the assent form, and the surveys were filled out following the given instructions. Additionally, the respondents received assistance when completing the survey questionnaires, and they were given adequate time to finish them. The signed assent forms and survey questionnaires were then retrieved. In the post data gathering stage, an Excel tool was utilized to individually encode and tabulate the scores after they had been properly collected. The variables found in the problem statement were retrieved using a summary sheet that contained all the information required for this study. After that, the data underwent statistical processing, analysis, and orderly tabulation. Additionally, the results from the statistical approaches applied enabled the interpretations. Similarly, the data from the outcome were discussed concurrently with the organization specified in the problem description. Additional pertinent research was presented to shed light on the discussion and further validate the facts.

The ethical framework of this study, which examined the relationship among self-confidence in learning higher mathematics, problem-solving strategies, and mathematics performance of Grade 10 students in one of the public secondary schools in Barili, Cebu during the School Year 2025–2026, was upheld with full regard for the rights, dignity, and welfare of all participants. The researcher strictly adhered to the ethical guidelines of the American Psychological Association (APA, 7th edition) and the protocols prescribed by the Graduate Teacher Education Program of Cebu Technological University–Main Campus. Throughout the conduct of the study, transparency, respect, confidentiality, and accountability were consistently observed to protect the interests of all respondents and ensure the integrity of the research process. Prior to data collection, formal approval was secured from the school administration to ensure compliance with institutional policies and procedures. Participation in the study was voluntary. Before administering the research instruments, the purpose of the study, data collection procedures, expected duration, and voluntary nature of participation were clearly explained to the respondents. Informed consent was obtained from all participants, and they were informed of their right to withdraw from the study at any point without adverse consequences. This process ensured that participation was based on free and informed decision-making. The privacy of all participants was strictly protected throughout the study. Responses gathered through the survey questionnaires and records of mathematics performance were coded and anonymized to prevent the disclosure of personal identities. No identifying information appeared in any report, presentation, or publication arising from the study. Hard-copy documents were stored securely, while electronic files were password-protected and accessible only to the researcher.

In keeping with the principle of minimization of harm, all research procedures were designed to avoid physical, psychological, emotional, or social harm to participants. The administration of the research instruments posed minimal risk and did not interfere with the respondents' regular academic responsibilities. Participants were treated with fairness, respect, and sensitivity throughout the research process. The study also recognized and respected the participants' right to make independent decisions regarding their involvement. Respondents were provided with sufficient information about the study and were given the freedom to participate or decline without coercion. Open communication was maintained to address questions or concerns and to reinforce the voluntary nature of participation. In terms of beneficence, the study aimed to contribute meaningful insights into mathematics education by generating empirical evidence regarding the relationship among self-confidence in learning

higher mathematics, problem-solving strategies, and mathematics performance. The findings are expected to benefit students, teachers, school administrators, and future researchers by providing a basis for developing interventions and action plans that may enhance mathematics learning outcomes and academic achievement. Consistent with the principle of non-maleficence, all research activities were structured to prevent harm, discomfort, or inconvenience to participants. Data gathered were used solely for academic and research purposes and were handled with integrity and professionalism. Secure data management practices were implemented to prevent unauthorized access and misuse of information. By adhering to these ethical principles, the study ensured the protection of the respondents' rights, dignity, and welfare while maintaining integrity, transparency, and accountability throughout the research process.

After data collection, the data acquired underwent numerous statistical treatments with the aid of the statistician. To arrive at credible results, several statistical tools were used. The frequency count was used to determine the number of characteristics shared by the respondents, particularly in mathematics performance. Each response was recorded and tabulated, and the frequency distribution served as the basis for describing the respondents' mathematics performance. The simple percentage was utilized, specifically for mathematics performance, to determine the percentage of respondents who belonged to a particular performance category relative to the total number of respondents. The frequency of responses was divided by the total number of respondents and multiplied by 100. The weighted mean was utilized to numerically describe the level of self-confidence in learning higher mathematics and the level of mathematical problem-solving strategies. The standard deviation was used to determine the variability or dispersion of the respondents' scores from the mean. It provided information on the consistency of responses regarding self-confidence in learning higher mathematics, their mathematical problem-solving strategies, and mathematics performance. A low standard deviation indicated that responses were closely clustered around the mean, while a high standard deviation indicated greater variability among responses. The Pearson correlation coefficient (r), a parametric statistical tool, was used to test the relationship between the level of self-confidence in learning higher mathematics and the level of mathematical problem-solving strategies in the areas of identifying and analyzing the problem, selecting appropriate solution methods, and checking and evaluating the final answer. Spearman's correlation coefficient (rho), a non-parametric statistical tool, was used to test the relationship between the respondents' self-confidence in learning higher mathematics and their mathematics performance, as well as the relationship between their mathematical problem-solving strategies and mathematics performance. Prior to applying correlation analysis, the data were subjected to tests of normality and homogeneity of variance to ensure that the assumptions of parametric statistics were met. The Shapiro–Wilk test was used to examine whether the distribution of scores approximates normality (Frost, 2025), while Levene's test was employed to determine whether the variances across groups are equal (Levene, 1960; Tonggumnead & Saengngam, 2023). Establishing normality and homogeneity validated the appropriateness of using Pearson's correlation coefficient and strengthened the reliability of the statistical conclusions.

The following methods were used to calculate and evaluate data gathered from survey questionnaires. The mathematics performance rating scale was adapted from the D.O. 08 series of 2015, which describes students' performance numerically. A scoring range of 90-100 corresponds to the descriptive rating Outstanding, in which students demonstrate excellent mastery of mathematical concepts and skills, consistently exceed expectations, and accurately solve complex problems. A scoring range of 85-89 corresponds to Very Satisfactory, in which students show strong understanding of mathematical concepts and perform well in most tasks

with only minor errors. A scoring range of 80-84 corresponds to Satisfactory, in which students demonstrate adequate comprehension of mathematical principles and handle routine problems effectively but may need improvement in higher-order tasks. A scoring range of 75-79 corresponds to Fairly Satisfactory, in which students meet minimum academic standards and show basic understanding but require further enhancement of skills. A scoring range of below 75 corresponds to Did not meet the Expectations, in which students demonstrate insufficient mastery of mathematical concepts and require academic intervention and support. This part presented the mathematics performance of the respondents based on their quarterly grades. The grades were categorized according to the prescribed scoring range and corresponding descriptive ratings, which provided an overview of the students' level of academic achievement in mathematics.

Meanwhile, the level of the respondents' self-confidence was determined through a survey on how confident they are in learning mathematics in general. The scoring procedure for this variable is as follows. Scale 1, with a numerical rating of 1.00 – 1.74, corresponds to the descriptive rating Very Low, and this range represents the strongest level of rejection, showing clear and decisive disagreement with the statement. Scale 2, with a numerical rating of 1.75 – 2.49, corresponds to Low, and this range shows opposition, meaning respondents lean toward rejecting or not supporting the statement. Scale 3, with a numerical rating of 2.50 – 3.24, corresponds to High, and this range indicates general agreement, suggesting favorable views but with less intensity compared to the first level. Scale 4, with a numerical rating of 3.25 – 4.00, corresponds to Very High, and this range reflects the highest level of positive affirmation, showing very strong support for the statement. This portion presented the level of students' self-confidence in dealing with mathematics. The data reflected the respondents' perceived belief in their ability to understand mathematical concepts, solve problems, and participate in mathematics-related activities. The results were analyzed using the weighted mean and interpreted according to the established rating scale.

Lastly, problem-solving strategies refer to the methods and approaches students use in analyzing and solving mathematical problems. In this study, students' problem-solving strategies were assessed using a structured questionnaire. Responses were scored based on a predefined scale, with each item corresponding to specific indicators, as follows. Scale 1, with a numerical rating of 1.00-1.74, corresponds to the descriptive rating Poor, in which students demonstrate minimal understanding of problem-solving processes and struggle to interpret and solve problems independently. Scale 2, with a numerical rating of 1.75-2.49, corresponds to Fair, in which students show limited use of structured problem-solving strategies, often rely on trial-and-error methods, and need consistent guidance. Scale 3, with a numerical rating of 2.50-3.24, corresponds to Very Good, in which students frequently use appropriate strategies and logical reasoning, solve problems correctly with minimal guidance, and demonstrate clear understanding of procedures. Scale 4, with a numerical rating of 3.25-4.00, corresponds to Excellent, in which students consistently apply systematic and effective problem-solving strategies, analyze problems carefully, select appropriate methods, and verify their solutions accurately and independently. This part showed the level of students' problem-solving strategies in mathematics. This variable measured how students analyze mathematical problems, apply appropriate procedures, and arrive at solutions. The responses were quantified using the weighted mean and interpreted based on the given descriptive rating scale.

RESULTS AND DISCUSSION

This chapter presents and interprets the data gathered from 66 Grade 10 respondents in a public secondary school in Barili, Cebu. Data were collected through a survey questionnaire

that measured the respondents' self-confidence in learning higher mathematics and their mathematical problem-solving strategies in three areas: identifying and analyzing the problem, selecting appropriate solution methods, and checking and evaluating the final answer. Mathematics performance was represented by the respondents' numerical grades. Weighted means, standard deviations, frequencies, and percentages described the variables. The Shapiro-Wilk test assessed normality, and Pearson r and Spearman's rho tested the relationships among the variables at the 0.05 level of significance. The discussion is grounded in the data gathered, and all results are interpreted in direct relation to the objectives of the study, namely to determine the respondents' level of self-confidence, their problem-solving strategies, and their mathematics performance, and to examine the relationships among these variables.

Self-confidence in learning higher mathematics

Self-confidence in learning higher mathematics was defined as the learner's perception of their ability to understand, analyze, and provide concrete solutions to mathematical concepts and problems in Senior High School or tertiary mathematics. It is a salient factor in success because higher mathematics involves abstract thinking and multi-step problem-solving. Using the legend of 3.25 to 4.00 as Very High, 2.50 to 3.24 as High, 1.75 to 2.49 as Low, and 1.00 to 1.74 as Very Low, the respondents obtained an aggregate mean of 2.37 with an aggregate standard deviation of 0.71, verbally described as Low. Low ratings were obtained for the statements "Mathematics does not scare me at all" (WM = 2.23, SD = 0.72), "I can solve problems by just looking at the formula" (WM = 2.45, SD = 0.68), "I can solve problems through different strategies" (WM = 2.26, SD = 0.73), "I am comfortable expressing my own ideas on how to look solutions to a difficult problem in math" (WM = 2.45, SD = 0.73), "I am comfortable answering questions in math class" (WM = 2.38, SD = 0.70), "I am able to solve mathematical problem without too much difficulty" (WM = 2.09, SD = 0.70), "I can easily solve problems without any distraction" (WM = 2.27, SD = 0.60), and "Mathematics excites me" (WM = 2.23, SD = 0.76). These items reflect perceived capabilities, emotional responses, and independence in dealing with mathematical problems. High ratings were obtained for only two items: "I get great deal of satisfaction out of solving a mathematics problem" (WM = 2.52, SD = 0.73), which expresses satisfaction in dealing with mathematics, and "Studying at home helps me improve my problem-solving skills" (WM = 2.80, SD = 0.73), which concerns a strategy for improving mathematical ability.

Kunhertanti and Santosa (2018) stated that self-confidence significantly influences students' success in learning mathematics, and related studies report a favorable connection between self-confidence and mathematics learning outcomes. The overall Low result therefore suggests that most of these students still lack the ability and foundation to deal with the complex and abstract problems of higher mathematics.

Mathematical problem-solving strategies

The respondents' strategies were examined along the three stages of Polya's framework. The legend used was 3.25 to 4.00 as Excellent, 2.50 to 3.24 as Very Good, 1.75 to 2.49 as Fair, and 1.00 to 1.74 as Poor.

Identifying and analyzing the problem. The first stage of Polya's framework concerns fully understanding the problem before attempting a solution. Learners recognize the given information, determine what is asked, and identify relationships among relevant concepts, so that they do not jump into solving blindly. The respondents obtained an aggregate mean of 2.49

with an aggregate standard deviation of 0.84, interpreted as Fair, which indicates that they are still developing their skills in this area.

Several indicators were rated Very Good, suggesting strengths in specific strategies. These were analyzing the problem again and again (WM = 2.65, SD = 0.90), underlining important words (WM = 2.86, SD = 0.89), taking time to design an action plan before calculating (WM = 2.59, SD = 0.80), asking oneself questions to ensure understanding (WM = 2.73, SD = 0.80), repeatedly practicing similar question types (WM = 2.55, SD = 0.84), and studying class notes and textbook again and again (WM = 2.55, SD = 0.98). Further Very Good ratings were obtained for rereading the task (WM = 2.76, SD = 0.75), selecting the relevant information needed (WM = 2.52, SD = 0.83), memorizing key formulas (WM = 2.61, SD = 0.91), linking class notes to textbook examples (WM = 2.52, SD = 0.92), reading through notes and textbook to find the most important parts (WM = 2.61, SD = 0.89), and marking up important parts of class notes (WM = 2.77, SD = 0.94). The remaining Very Good ratings were for listing related formulas first (WM = 2.70, SD = 0.86), writing down in one's own words what is already known (WM = 2.52, SD = 0.79), selecting relevant steps (WM = 2.53, SD = 0.86), orderly noting of problem-solving steps (WM = 2.68, SD = 0.83), and putting together the information needed (WM = 2.53, SD = 0.86). Making notes related to the problem (WM = 2.83, SD = 0.85) falls within the Very Good range, although the source table left its description blank. These results suggest that learners are relatively capable in basic comprehension and information-highlighting strategies.

The majority of indicators were rated Fair, signaling areas for improvement. These were marking up important lines for concept organization (WM = 2.47, SD = 0.85), selecting relevant numbers or data (WM = 2.35, SD = 0.87), adhering systematically to the plan (WM = 2.15, SD = 0.73), relating the given problem to other problems (WM = 2.36, SD = 0.74), having an idea or estimate of the possible outcome (WM = 2.21, SD = 0.79), and comparing the teacher's explanation with textbook content (WM = 2.24, SD = 0.88). Also Fair were using class materials as a starting point for one's own viewpoint (WM = 2.27, SD = 0.85), reorganizing and clarifying confused points after class (WM = 2.45, SD = 0.81), searching for patterns or symmetry (WM = 2.41, SD = 0.91), selecting relevant materials (WM = 2.45, SD = 0.79), writing down in one's own words what was asked (WM = 2.41, SD = 0.82), and combining one's own ideas into class learning (WM = 2.21, SD = 0.87). The last Fair ratings were for categorizing easy and hard exam questions (WM = 2.38, SD = 0.87), finding another efficient way after hearing an idea or solution (WM = 2.47, SD = 0.77), setting one's own target and agenda (WM = 2.35, SD = 0.85), dividing problems into parts (WM = 2.33, SD = 0.77), relating a future problem (WM = 2.29, SD = 0.87), and making a drawing related to the problem (WM = 2.20, SD = 0.88). These are the more complex, higher-order strategies and those involving self-generated understanding.

Overall, respondents exhibit surface-level strategies such as rereading, note-taking, and reviewing, but need to develop deeper analytical skills such as devising a concrete plan, connecting relevant concepts, and restructuring given problems. Ayaz and Aydogdu (2008) noted that problems cannot be solved correctly without understanding their context, which requires knowing both what must be found and the information that must be put together. Sinaga et al. (2023) observed that mathematics performance depends highly on the capacity to solve problems and to know when and how to apply specific knowledge and techniques. Putri et al. (2023) added that deeper mathematical understanding, achieved by relating concepts, supports the productivity of new ideas in problem-solving. Instructional support focused on higher-order thinking and strategic problem analysis is therefore warranted, since understanding the problem draws on students' metacognitive skills.

Selecting appropriate solution methods. The second stage of Polya's framework is devising a plan. After analyzing a problem, learners think of strategies such as drawing diagrams, making tables, guess and check, and using equations. The respondents obtained an aggregate mean of 2.38 with an aggregate standard deviation of 0.82, interpreted as Fair, which indicates a moderate level of competence in choosing applicable schemes.

Respondents performed better in fundamental and procedural skills. Very Good ratings were obtained for knowing how and when to add, subtract, multiply, and divide (WM = 2.71, SD = 0.94), using trial and error when the formula is unknown (WM = 2.55, SD = 0.96), following the method step by step to get the right answer (WM = 2.89, SD = 0.81), and being aware of what "borrowing" means in subtraction (WM = 2.67, SD = 0.98). Also rated Very Good were knowing what "carrying" means in addition and how to use it (WM = 2.56, SD = 0.88), acting according to the plan (WM = 2.53, SD = 0.79), and following the sequence of problem-solving steps orderly (WM = 2.59, SD = 0.89), the last of which falls within the Very Good range although its description was blank in the source table. Students appear confident and capable with structured, rule-based, and familiar processes.

Most indicators were rated Fair, reflecting limitations in higher-order and strategic thinking. Lower performance was seen in questioning what is heard in class and judging whether it is persuasive (WM = 2.20, SD = 0.81), having one's own tactics (WM = 2.06, SD = 0.82), combining known knowledge with learning materials (WM = 2.38, SD = 0.84), making simple charts and tables (WM = 2.18, SD = 0.74), and visualizing the scenario by drawing (WM = 2.21, SD = 0.77). Akkaya and Dilekli (2025) asserted that analytical or strategic thinking fosters more organized and meaningful techniques and a deeper grasp of mathematical concepts, but students must learn the conceptual basis underlying the procedural steps for this to be effective. Selecting calculations and estimating an outcome (WM = 2.30, SD = 0.80), manipulating general formulas (WM = 2.14, SD = 0.70), and applying varied strategies such as guess and check or diagrams (WM = 2.44, SD = 0.86) were only moderately evident. Metacognitive and reflective practices were also Fair: using arithmetic in solving (WM = 2.32, SD = 0.81), using strategies that provide a definite way to reach a goal (WM = 2.29, SD = 0.87), being correct in calculations (WM = 2.27, SD = 0.62), reflecting carefully on difficult exercises and quickly on easy parts (WM = 2.36, SD = 0.80), making correct use of units (WM = 2.24, SD = 0.70), not forgetting problem-solving steps (WM = 2.17, SD = 0.69), and monitoring the process and changing the plan if necessary (WM = 2.35, SD = 0.85). Students may find it challenging to regulate and assess their own thinking independently. Embodo and Andam (2024) attested that insufficient metacognitive skills make learners less able to use suitable learning strategies, which negatively affects their cognitive abilities in mathematics. Overall, respondents are better equipped with routine and procedural skills than with selecting, adapting, and evaluating solution strategies, which supports instructional approaches that strengthen critical thinking, strategic variation, and metacognitive development.

Checking and evaluating the final answer. This stage involves verifying and reviewing the solution after solving. The respondents obtained an aggregate mean of 2.49 with an aggregate standard deviation of 0.82, interpreted as Fair, which indicates an average level of competence.

Respondents performed relatively well in basic verification. Very Good ratings were obtained for checking the answer again after finishing (WM = 2.79, SD = 0.85), checking calculations by calculating again (WM = 2.65, SD = 0.85), repeatedly practicing similar question types (WM = 2.67, SD = 0.88), summarizing and reflecting on the answer (WM = 2.61, SD = 0.86), clarifying whether a wrong answer is a conceptual mistake or a miscalculation (WM = 2.53, SD = 0.83), checking the answer against the estimated outcome (WM = 2.53, SD

= 0.77), and going over to find out where the problem is (WM = 2.59, SD = 0.80). These results indicate the capability to carry out routine checking involving repetition, confirmation, and procedural verification. Wangguway et al. (2025) described problem-solving as a complex process involving cognitive operations such as gathering and selecting relevant details, heuristic techniques, and metacognitive strategies. Metacognition, which comprises self-assessment, cognitive approaches, awareness, and analytical planning, is linked to academic success and problem-solving skills and is a recommended method for teaching mathematics.

The remaining indicators were rated Fair, pointing to a learning gap in deeper evaluative and reflective thinking. These were linking mathematics with other subjects (WM = 2.42, SD = 0.80), reflecting and giving an answer only when all is checked (WM = 2.48, SD = 0.79), drawing a conclusion referring to the task (WM = 2.17, SD = 0.78), reflecting on what went well and how tasks were solved (WM = 2.32, SD = 0.71), using a real example to verify the conclusion (WM = 2.36, SD = 0.83), going over formulas and concepts independently (WM = 2.36, SD = 0.87), and finding daily life samples to link with math materials (WM = 2.33, SD = 0.79). Students know how to check whether an answer is right but are less likely to engage in meaningful deliberation, conceptual assessment, and real-life application of their solutions. This agrees with García-García et al. (2024), who found that learners rely on step-by-step procedures but struggle to establish deeper mathematical connections and meanings. Jatisunda et al. (2025) likewise found that students master routine and repetitive tasks, yet their explanations were procedural narrations rather than explicit justifications.

Summary of problem-solving strategies. All three components were described as Fair. Identifying and analyzing the problem had a weighted mean of 2.49 (SD = 0.84), selecting appropriate solution methods 2.38 (SD = 0.82), and checking and evaluating the final answer 2.49 (SD = 0.82), giving a grand mean of 2.45 and a grand standard deviation of 0.83. The respondents thus show moderate proficiency, with considerable room for improvement across all components. The first and third components share the highest weighted mean of 2.49, suggesting that respondents take the first and final stages seriously, since understanding the problem and evaluating the answer are key to accurate solutions. The lower mean of 2.38 for selecting solution methods implies a need to use metacognitive skills more effectively in choosing suitable methods. Dela Cruz (2025) claimed that learners know cognitive and metacognitive strategies such as organizing, monitoring, and evaluating but find it hard to use them consistently, leading to lower performance. Torregrosa and Albarracín (2025) noted that learners who consistently self-manage their metacognitive abilities are likely to obtain better mathematics performance.

Mathematics performance

Mathematics performance, reflected in the respondents' numerical grades, indicates their overall level in the subject and their readiness for higher mathematics in Senior High School. The legend was 90 to 100 as Outstanding, 85 to 89 as Very Satisfactory, 80 to 84 as Satisfactory, 75 to 79 as Fairly Satisfactory, and below 75 as Did not Meet the Expectations. Of the 66 respondents (100.00%), 15 (22.73%) were Outstanding, 12 (18.18%) Very Satisfactory, 16 (24.24%) Satisfactory, 21 (31.82%) Fairly Satisfactory, and 2 (3.03%) Did not Meet the Expectations. The mean of 83.11 falls under Satisfactory, and the standard deviation of 6.75 indicates a slight spread, with most grades close to the mean. Performance was concentrated in the average to above-average range, and the largest proportion (31.82%) was Fairly Satisfactory, followed by Satisfactory (24.24%) and Outstanding (22.73%).

Many students possess sufficient mastery of mathematical concepts, but few reach the highest levels. PISA (2022) identifies a portion of learners who fail to reach baseline

proficiency, consistent with the presence of low-performing students here. Padawag (2025) found that students demonstrate basic skills such as numerical reasoning and calculation, but that teaching approaches and academic environment often block the development of higher-order skills. Higher-order thinking and suitable remediation for lower-performing students are therefore needed for a more stable performance distribution.

Relationships among the variables

Self-confidence and problem-solving strategies. The Shapiro-Wilk test showed that self-confidence ($W = 0.971$, $p = 0.125$) and problem-solving strategies ($W = 0.984$, $p = 0.566$) were normally distributed, since both p values exceeded 0.05. Because both variables were continuous and normal, Pearson r was used. The result was $r = 0.552$, a moderate positive relationship, with $p = 0.000$, significant at $p < 0.05$ (two-tailed). The null hypothesis of no significant relationship was rejected. As self-confidence increases, the application of effective problem-solving strategies improves correspondingly, and students who believe more in their abilities are more likely to use suitable strategies. Wahyuni et al. (2024) confirmed that self-confidence contributes significantly to problem-solving, particularly in geometry, and positive emotions such as self-confidence show a stronger positive correlation with mathematics success and cognitive accomplishments. Daiman et al. (2024) found that self-confident students tend to be calmer, organize their thoughts more clearly, and face challenging mathematical situations more readily. Fostering self-confidence is therefore important for enhancing problem-solving abilities and overall achievement.

Self-confidence and mathematics performance. Mathematics performance was not normally distributed ($W = 0.940$, $p = 0.003$), since p was below 0.05, so Spearman's rank-order correlation was used. The result was a weak positive relationship ($\rho = 0.306$, $p = 0.012$), significant at $p < 0.05$ (two-tailed), and the null hypothesis was rejected. Performance tends to improve as self-confidence rises, but the weak strength shows that self-confidence is not the sole factor. The p value indicates that the relationship is unlikely to be due to chance. Although the effect is not substantial, more confident students are more likely to perform well, and self-confidence works together with cognitive ability, learning strategies, and instructional support. Kunhertanti and Santosa (2018) reported that self-confidence is positively correlated with mathematical learning outcomes. Byiringiro (2024) found that self-confidence plays a positive role in mathematical understanding, although difficulty relating concepts to practical applications may hinder it. Increased engagement and exposure to real-world situations may raise self-confidence and, in turn, learning efficacy and performance. Self-confidence is a substantial but constrained predictor of achievement and should be combined with productive study techniques, solid conceptual knowledge, and suitable problem-solving techniques.

Problem-solving strategies and mathematics performance. Because mathematics performance violated normality, Spearman's rho was again used, as a nonparametric test that does not require normally distributed data. The result was a weak positive relationship ($\rho = 0.406$, $p = 0.000$), significant at $p < 0.05$ (two-tailed), and the null hypothesis was rejected. Students' performance tends to rise when they use better and more efficient strategies, and although the link is weak, it is significant. Students who are more strategic in analyzing, planning, and evaluating solutions are more likely to perform better, but performance is also influenced by cognitive capacity, prior knowledge, motivation, and instructional support. Villegas et al. (2024) found a significant relationship between problem-solving strategies and performance, and that improved strategies could result in improved performance. Embodo and Andam (2024) reported that problem-solving strategies significantly improved the academic

achievement of their experimental group compared with those who did not receive the intervention. Improving students' capacity to organize, analyze, and assess solutions can therefore support higher academic performance, especially alongside other learning supports.

Synthesis

Among the 66 respondents, self-confidence in learning higher mathematics was Low (aggregate mean = 2.37, SD = 0.71), and problem-solving strategies were Fair across all three stages (grand mean = 2.45, grand SD = 0.83). Mathematics performance was Satisfactory (mean = 83.11, SD = 6.75). Self-confidence was significantly related to problem-solving strategies (Pearson r = 0.552, p = 0.000), to mathematics performance (Spearman's $\rho = 0.306$, $p = 0.012$), and problem-solving strategies were significantly related to performance ($\rho = 0.406$, $p = 0.000$), with all null hypotheses rejected at the 0.05 level. These findings address each objective of the study. They show that learners are stronger in procedural and routine strategies than in strategic selection and deep evaluation, and that affective and cognitive factors jointly shape performance. The study contributes local evidence that strengthening self-confidence and metacognitive problem-solving may improve mathematics outcomes, and it prepares the way for the conclusions and recommendations in the next chapter.

CONCLUSION

This study examined the relationship among self-confidence in learning higher mathematics, the use of problem-solving strategies, and mathematics performance of Grade 10 students in a public secondary school in Giloctog, Barili, Cebu, in preparation for their transition to Senior High School, where more complex mathematics is expected. Using a quantitative descriptive-correlational design and complete enumeration of all Grade 10 students, the study gathered data through a survey questionnaire on self-confidence and problem-solving strategies, while the students' third quarter grades served as the measure of mathematics performance. The data were treated with the weighted mean, standard deviation, Pearson r, and Spearman's Rank-Order Correlation (rho). Based on the findings, it can be concluded that the majority of the students have low self-confidence in learning higher mathematics. This low level was evident in almost all indicators, which suggests that many students still lack the skills and foundational knowledge needed to handle complex and abstract mathematical problems. It also indicates that they are underprepared for the demands of more advanced mathematics in Senior High School.

In relation to problem-solving, the respondents' strategies, measured through Polya's three stages of identifying and analyzing the problem, selecting appropriate solution methods, and checking and evaluating the final answer, were interpreted as "Fair." This result reflects a moderate level of proficiency and implies that, while the students possess some basic problem-solving skills, considerable room for improvement remains across all components. It can therefore be inferred that their strategies are more procedural than conceptual. The students can carry out routine steps effectively, such as reading the problem, taking notes, and rechecking calculations. However, they encounter difficulty with higher-order heuristic skills, such as visualizing problems and strategically manipulating formulas. This pattern is consistent with the low confidence observed earlier, since limited conceptual grounding is likely to weaken students' assurance when facing unfamiliar or abstract tasks.

With respect to mathematics performance, most respondents obtained satisfactory to fairly satisfactory results, and only a few reached an outstanding level or failed to meet expectations. Although many students achieved generally satisfactory grades, the findings

point to a continuing need to strengthen higher-order thinking skills. They also call for appropriate remedial interventions for lower-performing students so that performance becomes more consistent and more evenly distributed. Moreover, the study found significant relationships among self-confidence, mathematical problem-solving strategies, and mathematics performance, which shows that these variables are interconnected and play important roles in students' learning outcomes. At the same time, academic improvement also depends on other factors, including effective study habits, strong conceptual understanding, and appropriate learning support, so these variables should not be regarded as the only determinants of achievement.

In light of these conclusions, the researcher recommends the adoption and implementation of the SPARK Plan (Strategic Plan for Advancing Research-based Knowledge in Mathematics). Through focused interventions and classroom-based activities, the plan seeks to strengthen students' problem-solving techniques, boost their confidence in higher mathematics, and develop their higher-order thinking abilities. Because self-confidence and problem-solving strategies were both found to be significantly related to mathematics performance, the plan is designed to develop these competencies concurrently. Its implementation is anticipated to increase student engagement in mathematical learning, promote more consistent academic performance, and lead to better mathematics achievement, thereby better preparing students for the challenges of Senior High School.

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