

Examining the Correlation and Predictive Power of Metacognitive Domains on Mathematics Performance Among Senior High School Students

Jose A. Catador Jr.

Kapayapaan Integrated School, Division of Calamba City, Laguna, Philippines

Author Email: catadorjr@gmail.com

Date received: May 2, 2024

Date revised: May 22, 2024

Date accepted: May 28, 2024

Originality: 96%

Grammarly Score: 99%

Similarity: 4%

Recommended citation:

Catador, J. (2024). Examining the correlation and predictive power of metacognitive domains on Mathematics performance among senior high school students. *Journal of Interdisciplinary Perspectives*, 2(7), 446-454. <https://doi.org/10.69569/jip.2024.0192>

Abstract. This study aims to determine the correlation and predictors of students' performance in mathematics based on the eight domains of metacognition: declarative, procedural, conditional, planning, information management strategy, comprehension monitoring, debugging strategy, and evaluation. This study employed a descriptive-correlational research design conducted with 272 Senior High School Grade 11 students enrolled in the academic track. The research instruments utilized were the Metacognitive Awareness Inventory to assess students' metacognitive awareness while the multiple-choice test was used to measure students' performance in mathematics, with reliability coefficients of .853 and .790, respectively. Descriptive and inferential statistics, such as Chi-square and multiple regression analysis, were employed to interpret and analyze the data. Utilizing the descriptive statistics, results reported that metacognitive knowledge attained a mean score of 3.69 while the metacognitive control/regulation obtained a mean score of 3.65 with an overall mean score of 3.67 interpreted as aware, respectively. Furthermore, the results revealed a significant association between students' performance in mathematics and their metacognitive awareness. The study highlighted that high-performing students in mathematics were those who effectively utilized and managed their metacognitive awareness. Moreover, it was found that greater awareness of metacognitive thinking correlated with better performance in mathematics. Additionally, the results indicated that 75.3% of metacognitive domains contributed to students' success in mathematics. However, only declarative, procedural, conditional, and debugging strategies significantly predicted students' success in mathematics. This suggests that students who effectively use and manage these specific metacognitive skills are more likely to excel in mathematics. In essence, this study highlights the crucial role of metacognition in mathematics learning. By fostering students' awareness and utilization of these powerful thinking strategies, teachers can empower learners to excel in mathematics and beyond.

Keywords: Mathematics performance; Metacognitive domains; Senior high school.

1.0 Introduction

The COVID-19 pandemic significantly aggravated pre-existing learning gaps, particularly in General Mathematics. Several factors contributed to this challenge were limited opportunities for self-verification due to restricted teacher-student interaction, thus hindering students' ability to verify their understanding through real-time feedback and clarification. Additionally, the implementation of remote learning reduced access to immediate support hindering timely clarification of doubts and addressing learning roadblocks. Hence, remote learning presented challenges in comprehensively assessing various mathematical skills due to limitations in traditional methods such as giving quizzes and quarterly exams. While DepEd Order No. 031, series 2020, emphasized written works (40%) and performance tasks (60%) to assess learning objectives, solely relying on these methods limits the evaluation of diverse mathematical capabilities. This approach aimed to gauge content knowledge,

abilities, and skills through learning portfolio, self-reflection and evaluation based on rubrics. Furthermore, the absence of quarterly exams hindered the ability to gauge students' progress throughout the learning period. These limitations collectively contributed to a situation where students might possess weaker foundational mathematical skills. This, in turn, could negatively impact their preparedness for more advanced coursework, potentially hindering their academic progress.

These findings highlight the pressing need for intervention to address the identified learning gaps. This study, driven by a desire to comprehend the underlying challenges, has the potential to serve a critical role in informing and shaping such interventions. While factors like the pandemic and potential pre-existing issues likely contribute to the observed performance, further exploration is crucial to fully understand the root causes of these learning gaps. Delving into the cognitive processes of students can be a valuable first step in this endeavor.

The present study investigates the association between metacognitive awareness and mathematics performance among students. It further explores the predictive power of eight metacognitive domains (declarative, procedural, conditional, planning, information management strategy, debugging strategy, comprehension monitoring, and evaluation) on mathematics performance. By gathering and analyzing this information, teachers can gain a deeper understanding of how students think and learn mathematics. This enhanced understanding can then inform the development and implementation of more effective interventions tailored to address individual student needs and learning gaps, ultimately leading to improved mathematics performance.

Metacognition, a concept initially introduced by Flavell (1979), refers to the capacity for self-reflection and control over one's cognitive processes. This involves self-awareness, monitoring learning progress, and critically evaluating learning strategies. While Kuhn and Dean (2004) emphasize awareness and management of thoughts, Swanson (1990) highlights how metacognition allows for strategic problem-solving and self-regulation in learning. Moreover, Flavell (1979), Efklides (2008; 2011) underscore the importance of recognizing and employing key strategies like planning, information management, monitoring, and evaluation for optimal learning. Metacognition encompasses the capacity to leverage existing knowledge in strategizing, problem-solving, and critical evaluation within learning contexts (Wilson & Conyers, 2016). This dynamic process involves applying prior understanding to formulate tailored approaches, actively monitoring progress, reflecting on outcomes, and flexibly adapting strategies as required. By fostering metacognitive skills, individuals can tailor their learning approach, strategize effectively, and cultivate higher-order thinking.

Flavell's (1979) influential work identifies metacognitive knowledge and metacognitive control/regulation as the foundational components of metacognition. Metacognitive knowledge encompasses self-understanding of one's cognitive processes, strengths, and limitations. This awareness includes optimal learning styles and knowledge of task-appropriate strategies. Crucially, accurate self-assessment underpins effective problem-solving, as inaccurate perceptions can lead to the use of unsuitable strategies. Flavell further categorizes metacognitive knowledge into three domains: person variables - the individual cognitive, emotional, and behavioral tendencies; task variables - understanding how the inherent nature of tasks dictates optimal approaches; and strategy variables - knowledge of diverse problem-solving strategies and their context-specific effectiveness.

Building metacognition, as described by Schraw and Dennison (1994), involves developing three key skills: declarative knowledge - understanding your strengths and weaknesses as a learner; procedural knowledge - knowing how to implement various learning strategies; and conditional knowledge - recognizing when and why to use specific strategies for optimal learning. Declarative knowledge refers to factual knowledge and understanding about oneself as a learner. This includes awareness of one's own skills, strengths, weaknesses, and learning resources. Additionally, it encompasses the information a student needs to grasp before engaging in critical thinking or analysis within a specific subject. Talks, demonstrations, and presentations are effective methods for conveying this type of knowledge (Schraw and Dennison, 1994). Procedural knowledge involves understanding how to apply specific learning strategies to accomplish tasks. Knowing the steps involved and when to use strategies in different contexts is crucial. Students develop procedural knowledge through problem-solving, cooperative learning, and discovery-based activities (Schraw and Dennison, 1994). Conditional knowledge involves understanding when and why to apply specific learning strategies for optimal effectiveness. It helps determine the best methods or skills to use in different situations. Students can develop conditional

knowledge through simulations that demonstrate how declarative and procedural knowledge are applied in various contexts. This knowledge allows them to adapt their tactics and utilize their strengths to overcome learning challenges (Schraw and Dennison, 1994).

Furthermore, metacognitive control and regulation allow an individual to manage their own thought processes using their knowledge. It involves practices that help direct their learning and thinking (Ozsoy & Ataman, 2009). This means controlling one's behavior and motivation to optimize their learning experience and overcome obstacles. According to Schraw and Dennison (1994), metacognitive control/regulation includes five key skills: planning, information management strategy, comprehension monitoring, debugging strategies, and evaluation. Planning includes goal setting, resource allocation, and outlining the steps to achieve a learning objective. This helps students identify what they already know, what they need to learn, and potential learning approaches. Information management strategy employs organizing, summarizing, and selective focusing to process information effectively. It helps students prioritize relevance, identify key points, and connect new knowledge with their existing understanding. Comprehension monitoring involves students tracking their understanding and evaluating their chosen strategies. Encourages students to monitor their progress and evaluate how well they comprehend new material. Debugging strategies help resolve misunderstandings and performance issues. Students reassess assumptions when facing confusion and seek clarification from others. Evaluation helps students analyze their performance and the effectiveness of their chosen strategies. Students judge their overall success in completing a learning task.

2.0 Methodology

2.1 Research Design

The present study used a descriptive-correlational research design. According to Creswell (2009), this study design elaborates on and quantifies the degree of association connecting two or more variables or sets of variables. This design is supported by the Pearson-r correlation, which further clarifies the strength of the connection between variables having linear relationships. This approach aligns with Sousa, Driessnack, and Mendes (2007) who emphasize that descriptive-correlational designs are valuable for examining naturally occurring relationships between variables. In this study, the researcher aimed to assess the correlation between metacognition and the mathematics performance of the Grade 11 students at Kapayapaan Integrated School. Furthermore, the present study explored the predictors of mathematics performance based on the eight metacognitive domains, necessitating an understanding of the existing association, making this design an appropriate choice.

2.2 Research Participants

A total of 272 respondents participated in the study. To ensure representatives across the different strands, a stratified random sampling procedure was employed. This involves dividing the population into strata based on their strand and then randomly selecting a proportionate number of participants from each stratum. The sample included students from three strands: 85 from ABM, 136 from HUMSS, and 51 from STEM. Following the stratification, simple random sampling was used within each strand to obtain the final sample of 272 students. This method ensured that each student within a specific strand had an equal chance of being selected, further contributing to the overall representatives of the sample.

2.3 Research Instrument

The researcher employed a researcher-made multiple-choice test to assess the mathematical performance of Grade 11 students. The test consisted of fifty (50) multiple-choice items and was designed by the Department of Education's guidelines for General Mathematics, focusing on topics such as relations and functions, rational functions, and exponential and logarithmic functions. To ensure the validity and reliability of the research instrument, the researcher sought the assistance of three (3) master teachers in mathematics for validation purposes. The test was pilot-tested with thirty (30) Grade 12 students and underwent item analysis. Using the Kuder-Richardson method, the overall reliability coefficient was determined to be .853, indicating that the test is highly reliable as a classroom assessment tool. The learner's performance was interpreted as high performing with a score ranging from 38-50, average performing with a score of 28-37, and low performing with a score of 0-27.

The Metacognitive Awareness Inventory, originally developed by Schraw and Dennison (1994), was used in this study. It consists of eight domains such as declarative, procedural, conditional, planning, information

management strategy, debugging strategy, comprehension monitoring, and evaluation. The domains were assessed using a 52-item questionnaire. Participants responded to each item using a five-point Likert scale ranging from 1 (never), 2 (seldom), 3 (sometimes), 4 (frequent) and 5 (always). To ensure the validity and reliability of the instrument, the researcher sought the help of the master teachers to assess the validity and suitability of the items in each indicator. The questionnaire was then pilot-tested to thirty (30) Grade 12 students and underwent Cronbach's alpha analysis, resulting in an alpha coefficient of 0.79, which indicates high internal consistency.

2.4 Data Gathering Procedure

The researcher employed a comprehensive and ethically responsible data gathering procedure. First, a formal letter was sent to the School Head to ask permission to conduct the study. This is to ensure the alignment with school policies and establish trust with the school administration. After the approval of the letter, the researcher then proceeded to the target respondents, clearly explaining the study's purpose, and requesting their voluntary participation in answering the survey questionnaire. After all the permissions were granted, the survey questionnaires were administered to the target respondents. After data collection was completed, the gathered information was meticulously organized and tallied. Subsequently, appropriate statistical tools were employed to analyze the data, allowing for the extraction of meaningful insights and interpretation of results.

2.5 Data Analysis

The data gathered were interpreted descriptively and inferentially.

2.6 Ethical Considerations

Throughout the research process, the researcher placed great importance on upholding ethical standards. This involved showing respect for the voluntary participation of the respondents. The researcher made sure that the respondents fully understood the implications of the study and willingly took part, without any form of pressure or coercion. The survey instruments used were free from any bias, discrimination, or offensive content. Additionally, the researcher was diligent in acknowledging and crediting the source materials used. The researcher took care to provide accurate citations, giving proper recognition to the work of other authors. Furthermore, the researcher prioritized the confidentiality and security of the data collected. The information was treated with the utmost respect and used solely for academic purposes, by the Data Privacy Act of 2012.

3.0 Results and Discussion

3.1 Students' Metacognitive Awareness in terms of Metacognitive Knowledge and Control/Regulation

Metacognitive knowledge, defined as an individual's understanding of their own learning processes, including factors influencing performance, available strategies, and the appropriate application of those strategies (Lai, 2011). Table 1 presents the distribution of metacognitive knowledge levels among the respondents. The results showed that the conditional knowledge had the highest mean score ($\bar{x} = 3.75$) on the metacognitive knowledge scale compared to the procedural ($\bar{x} = 3.66$) and declarative ($\bar{x} = 3.64$) domains. This mean score along with the overall mean score of 3.69, falls within the range interpreted as "aware". These findings suggest that, on average, students demonstrated a level of awareness about their thinking process.

Table 1. Descriptive statistics of students' metacognitive awareness in terms of metacognitive knowledge and control/regulation

DOMAIN	MEAN	S.E. OF MEAN	SD	MINIMUM	MAXIMUM	INTERPRETATION
Metacognitive Knowledge						
Declarative	3.64	.035	.580	2.00	5.00	Aware
Procedural	3.66	.037	.603	1.75	5.00	Aware
Conditional	3.75	.040	.662	2.00	5.00	Aware
Overall Mean	3.69	.034	.556	2.04	4.96	Aware
Metacognitive Control/Regulation						
Planning	3.75	.034	.556	2.43	5.00	Aware
Information Management Strategy	3.56	.035	.574	1.70	5.00	Aware
Comprehension Monitoring	3.57	.037	.604	1.14	4.86	Aware
Debugging Strategy	3.68	.034	.554	2.06	5.00	Aware
Evaluation	3.58	.037	.602	2.17	5.00	Aware
Overall Mean	3.65	.030	.511	2.08	4.85	Aware
Metacognitive Awareness						
Overall Mean	3.67	.031	.517	2.06	4.85	Aware

Several studies highlight the importance of metacognitive knowledge in mathematics achievement. Chytry et al. (2020) identified it as a key factor alongside mathematical intelligence. Their findings suggest that students with stronger metacognitive knowledge tend to perform better in mathematics. Similarly, Radmehr and Drake (2020) observed that students with greater metacognitive awareness in integral calculus were more successful in solving related problems. This positive correlation between metacognitive knowledge and academic performance extends beyond mathematics. Özçakmak et al. (2021) reported that individuals with higher levels of metacognitive understanding exhibit enhanced cognitive abilities, suggesting benefits across various academic domains. Supporting this notion, Md. Yunus & Ali (2008) also found a link between stronger metacognitive awareness and improved academic performance in general.

Moreover, metacognitive control and regulation, as defined by Ozsoy & Ataman (2009), refer to the self-directed management of thought processes through the application of learned knowledge. This involves utilizing specific practices to guide one's learning and thinking. In essence, it equips individuals to control behavior and motivation to optimize learning experiences and overcome challenges. The table below presents the distribution of metacognitive control/regulation levels across the different strands among the study respondents.

Analysis revealed that the planning achieved the highest mean score ($\bar{x} = 3.75$) on the metacognitive knowledge, followed by the debugging strategy ($\bar{x} = 3.68$), evaluation ($\bar{x} = 3.58$) and comprehension monitoring ($\bar{x} = 3.57$). However, the information management strategy obtained the lowest mean score ($\bar{x} = 3.56$). All domains, including the overall sample with a mean score of 3.65 fell within the range interpreted as "aware" on the scale. These findings suggest that, on average, students demonstrated a level of awareness about their self-regulation strategies. This suggests a baseline level of awareness across different academic specializations regarding their understanding of metacognitive strategies and their ability to apply these strategies to manage their learning. However, it is essential to acknowledge that a score within the "aware" range does not necessarily indicate the ability to effectively apply these strategies to manage learning.

Metacognitive skills, as defined by Schraw & Moshman (1995) and Du Toit & Kotze (2009), encompass the ability to manage learning and thinking activities. Research suggests a strong link between metacognitive skills and students' success (Belet & Guven, 2011; Menz & Xin, 2016; Nongtodu & Bhutia, 2017). Students with higher metacognitive abilities demonstrate stronger mathematical problem-solving and thinking skills (Menz & Xin, 2016; Nongtodu & Bhutia, 2017). Furthermore, studies have shown a positive correlation between metacognitive awareness and academic achievement. Students with strong metacognitive skills can identify areas of difficulty, choose appropriate learning strategies, assess their effectiveness, and adapt their study plans (Stanton et al, 2021). Teachers play a crucial role in fostering these skills by implementing teaching strategies that enhance student learning, promote self-monitoring, and control, and encourage social metacognition during collaboration work (Stanton et al., 2021).

3.2 Students' Metacognitive Awareness According to their Mathematics Performance

Table 2. Frequency distribution of students' metacognitive awareness according to their mathematics performance.

Table 2: Frequency distribution of students' metacognitive awareness according to their mathematics performance.															
	METACOGNITIVE KNOWLEDGE					METACOGNITIVE CONTROL/REGULATION					OVERALL				
	HP	AP	LP	Total	%	HP	AP	LP	Total	%	HP	AP	LP	Total	%
HA	43	7	0	50	18.4	40	7	0	47	17.3	42	4	0	46	16.9
A	34	103	1	138	50.7	36	93	1	130	47.8	36	108	0	144	52.9
MA	1	54	23	78	28.7	2	66	21	89	32.7	0	54	26	80	29.4
SA	0	2	4	6	2.2	0	0	6	6	2.2	0	0	2	2	.80
Total	78	166	28	272	100	78	166	28	272	100	78	166	28	272	100

Legend: FA – Highly Aware; A – Aware; MA – Moderately Aware; SA – Slightly Aware; HP – Highly Performing; AP – Average Performing; LP – Low Performing

Table 2 shows the distribution of students' metacognitive awareness about their mathematics performance. The data revealed that over half (50.7%) of students demonstrated an aware level of metacognitive knowledge. Additionally, a substantial portion (28.7%) exhibited a moderate level of awareness, while 18.4% showed a high level of awareness. Only a small percentage (2.2%) fell into the slightly aware category. In terms of metacognitive regulation, a similar pattern emerged. Nearly half (47.8%) of the students displayed an awareness level of control, with 32.7% at a moderate level. A noteworthy finding is the relatively high proportion (17.3%) of students in the

very high category. As with metacognitive knowledge, a small percentage (2.2%) belonged to the slightly aware group.

Furthermore, none of the respondents reported a “not aware” level of metacognitive awareness, whether metacognitive knowledge or metacognitive control/regulation. Analyzing student groupings based on their mathematics performance reveals interesting patterns. Among the 78 high-performing students, 42 (53.8%) exhibit high metacognitive awareness, and 36 (46.2%) are categorized as “aware.” This suggests a strong association between high metacognitive awareness and strong math performance. Meanwhile, as the data shifts with average performers, only 4 out of 166 (2.4%) are highly aware, while 108 (65.1%) are “aware,” and 54 (32.5%) are moderately aware. This indicates a wider range of metacognitive awareness levels within the average group, suggesting other factors might also contribute to their performance. Moreover, in the low performing group, 26 (92.9%) are moderately aware, and 2 (7.1%) are slightly aware. This limited data suggests the possibility of lower metacognitive awareness within this group, but further investigation is needed due to the small sample size.

While the presented data hints at a possible link, the statement mentions a chi-square test result in Table 3. Conducting this statistical test would determine if the observed association between metacognitive awareness and mathematics performance is statistically significant. These findings suggest that metacognitive awareness might indeed play a role in mathematics performance.

3.3 Test of Association between Mathematics Performance and Metacognitive Awareness

The presented table summarizes the analysis of the association between students’ mathematics performance and the level of metacognitive awareness. The results indicate a statistically significant correlation ($p\text{-value} < 0.01$) between the two variables. This finding suggests that students with higher levels of metacognitive awareness tend to demonstrate stronger performance in mathematics.

Table 3. Test of association between students’ performance in mathematics and their metacognitive awareness.

	VALUE	DF	ASYMP. SIG. (2-SIDED)
Pearson Chi-Square	190.353 ^a	6	.000
Likelihood Ratio	154.703	6	.000
Linear-by-Linear Association	114.724	1	.000
N of Valid Cases	272		

^aSignificant at $p < .01$

Metacognition, defined as the ability to leverage prior knowledge to plan learning activities, solve problems, reflect on and evaluate findings, and adapt approaches (Wilson & Conyers, 2016), has been linked to positive academic outcomes. Studies by Yunus & Ali (2008) and Abdelrahman (2020) demonstrate a correlation between stronger metacognitive awareness and higher academic achievement while Stanton et al. (2021) highlight how these skills empower students to navigate learning challenges and adjust strategies effectively.

Research further suggests that incorporating metacognitive strategies into instruction can enhance learning, particularly within mathematics. Abari & Tyovenda (2021) found that students using these strategies in math education significantly outperformed students exposed to conventional methods. Similarly, Jacobse & Harskamp (2009) reported that metacognitive prompts during problem-solving improved both comprehension and strategic application, while Kramarski & Friedman (2014) suggest that these prompts can foster self-regulation skills by promoting self-awareness of situations requiring additional support. These findings contribute to the understanding that metacognition, while potentially an inherent ability, can be actively nurtured through instructional practices. By encouraging students to utilize metacognitive skills during learning activities, teachers can potentially contribute to improved performance, particularly in subjects like mathematics.

However, it is important to acknowledge that the statement by Ayodele & Adeoye (2022) regarding metacognition as an “inbuilt” skill and “automatic behavior” requires further clarification and nuanced research. Metacognitive development is likely a complex process influenced by various factors, and further investigation is needed to fully understand its multifaceted nature. Overall, this body of research underscores the potential benefits of integrating metacognitive strategies into educational practices to enhance student learning and achievement.

3.4 Metacognition as Predictor of Mathematics Performance

Table 4 reveals a predictive relationship between metacognitive domains and students' mathematics performance. The analysis indicates that metacognition explains a substantial portion (75.3%) of the variation in math scores ($R^2=0.753$). Further, the F-test revealed a statistically significant relationship between metacognition and mathematics performance ($R^2 = 0.753$, $Df = 271$, $F = 100.417$, $p<.05$). This means that 75.3% of the variation in students' mathematics scores can be explained by the metacognitive domains. Furthermore, table 4 demonstrates the specific metacognitive domains - declarative, procedural, conditional, planning, IMS, comprehension monitoring, debugging strategy, and evaluation - all individually act as significant predictors of math success.

Table 4 presents that the metacognitive domains found to significantly predict students' mathematics performance. Analysis revealed that declarative (t-value=4.192, p-value<.01), procedural (t-value=3.719, p-value<.01), conditional (t-value=1.704, p-value<.05), and debugging strategy (t-value=2.323, p-value<.05) emerged as significant predictors.

Table 4. Regression Analysis on the Effect of Metacognitive Domain to the Mathematics Performance

MODEL	UNSTANDARDIZED COEFFICIENTS		STANDARDIZED COEFFICIENTS	T	SIG.	INTERPRETATION
	B	Std. Error	Beta			
1(Constant)	2.360	1.191		1.982	0.049	Significant
Declarative	2.066	0.493	0.225	4.192	0.000	Significant
Procedural	1.906	0.513	0.216	3.719	0.000	Significant
Conditional	0.850	0.499	0.106	1.704	0.048	Significant
Planning	0.533	0.579	0.056	0.920	0.358	Not Significant
Information Management Strategy	0.929	0.606	0.100	1.533	0.126	Significant
Comprehension Monitoring	-0.351	0.570	-0.040	-0.616	0.538	Not Significant
Debugging strategy	2.428	1.045	0.052	2.323	0.021	Not Significant
Evaluation	0.436	0.457	0.049	0.953	0.341	Not Significant

R=.868 (Strong Relationship); $R^2=.753$; Adjusted R=.746; SE=2.686; F=100.417; $p<.05$

Research suggests a positive link between metacognitive ability and mathematical achievement in high school (Van der Stel et al., 2010; Veenman et al., 2005). Abdelrahman (2020) further highlights metacognition's role as a strong predictor of academic success, with interventions enhancing metacognitive skills and subsequently, academic performance. These findings align with Yunus et al. (2009) who identified specific metacognitive knowledge domains, such as declarative, procedural, and conditional knowledge, as significant contributors to mathematics achievement. However, other studies present a more nuanced picture. Zulkiply (2008) emphasized the predictive power of planning, while Malekian & Saheb (2010) focused on information management strategies and control/monitoring processes. Similarly, Farnam & Anjomshoaa (2020) identified planning and cognitive awareness/strategy as having significant effects on students' academic motivation and achievement, respectively.

4.0 Conclusion

The analysis of student performance revealed valuable insights into their use of metacognitive knowledge and debugging strategies when tackling mathematical activities. The results suggest that students were generally effective and efficient in applying these skills. This finding implies a potential shift towards students relying more heavily on their strategic knowledge rather than simply recalling factual information. This positive trend indicates that students are becoming more strategic in their approach to mathematics. They are not only acquiring knowledge but also developing a deeper understanding of their own cognitive processes. This includes an awareness of their strengths and limitations when it comes to mathematical problem-solving.

Furthermore, the analysis suggests that students have developed an understanding of when and why to use the most appropriate method in different situations. This indicates their ability to apply both factual and procedural knowledge strategically. This skill can be further honed by incorporating simulations into the learning process. Simulations can effectively demonstrate how both types of knowledge are applied in various mathematical contexts. Additionally, the successful application of metacognitive knowledge suggests that students have likely been exposed to learning strategies like problem-solving, cooperative learning, and discovery-based activities. These activities play a crucial role in developing and reinforcing metacognitive awareness. Through these strategies, students learn to recognize when and why to utilize specific approaches for optimal learning. Through these strategies, students could ask clarifying questions to strengthen their understanding. Students reassess

assumptions when facing confusion and seek clarification from others. Therefore, it is necessary to practice students to ask questions so that proper feedback could be address to the learning situations.

In essence, the results suggest that students are adept at using their existing knowledge to overcome mathematical challenges. They also demonstrate a growing awareness of when to implement different strategies to address specific mathematical problems. This highlights the importance of building upon existing skills and encouraging students to become more independent and strategic learners. Asking clarifying questions results in a more successful mathematical problem-solving strategy.

Given the limitations of the current study, particularly the sample size and the specific academic setting, future research is recommended to explore this topic further with a large and more diverse participant pool. Additionally, incorporating other relevant variables into the research design could provide a more comprehensive understanding of the phenomenon under investigation.

5.0 Contributions of Authors

The single-authored study aimed to develop and recommend a strategy for addressing a problem in General Mathematics. The author conceptualized the research design, implemented the study, and prepared the manuscript. Future research with a larger team could explore the generalizability of the findings and refine the proposed strategy.

6.0 Funding

This work is funded by the author.

7.0 Conflict of Interests

The author declares no conflict of interest.

8.0 Acknowledgment

Special acknowledgement to everyone who made this study possible.

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