JOURNAL OF INTERDISCIPLINARY PERSPECTIVES

ISSN Print: 2984-8288, ISSN Online: 2984-8385
Vol. 2, No. 8, pp. 325-334, August 2024

Strategies Employed by Senior High School Students in Learning General Mathematics

Jezrel R. Palumar
Foundation University, Dumaguete City, Negros Oriental, Philippines

Author Email: jezrel.palumar@foundationu.com

Date received: June 7, 2024
Date revised: June 27, 2024
Date accepted: July 2, 2024

Originality: 91%
Grammarly Score: 99%
Similarity: 9%

Recommended citation:
Palumar, J. (2024). Strategies employed by senior high school students in learning General Mathematics. *Journal of Interdisciplinary Perspectives*, 2(8), 325-334. https://doi.org/10.69569/jip.2024.0269

Abstract. This study aimed to identify the strategies employed by students in learning General Mathematics during the pandemic and to examine the relationship of these strategies with selected variables. A descriptive-correlational research design was utilized, and systematic sampling was employed to select 126 Grade 12 respondents. Validated questionnaires were used to collect data, and statistical analyses including mean, weighted mean, t-test for independent data, Pearson correlation, Mann-Whitney U Test, Kruskal-Wallis Test, and ANOVA were conducted. The findings revealed that the extent of students' utilization of metacognitive, cognitive, and collaborative strategies was "high." Additionally, their academic performance in General Mathematics was found to be at a "satisfactory" level. Further analysis showed that students with outstanding academic standing before the pandemic (a) had a higher extent of utilization of the strategies compared to those with satisfactory and fairly satisfactory standings, and (b) performed better during the pandemic than those with very satisfactory, satisfactory, and fairly satisfactory ratings. However, no significant differences were found in the strategies employed by students when grouped according to sex and strand. Moreover, the extent of strategy utilization did not have a direct relationship with academic performance. These findings suggest a need for further research into additional factors that may influence learning outcomes. Exploring other variables impacting academic success and developing targeted interventions to enhance student performance is recommended.

Keywords: Academic performance; General Mathematics; Senior high school.

1.0 Introduction

Understanding students' learning strategies, especially in Mathematics, is crucial for their overall academic success. Mastery of Math skills is fundamental for Math and other subjects like Science, Social Studies, and even Music and Art (Jameel et al., 2016). The COVID-19 pandemic significantly disrupted traditional educational systems, forcing students and teachers to adapt to new modes of learning and teaching (Busuttil & Camilleri, 2020).

The Philippine government implemented measures to sustain education during the pandemic in response to these challenges. The Department of Education (DepEd) issued DepEd Order No. 12, Series of 2020, which established the Basic Education Learning Continuity Plan (BE-LCP) for the School Year 2020-2021 (Cahapay, 2020). This plan aimed to protect the health, safety, and well-being of students, teachers, and staff while ensuring the continuation of education. Given the diverse learning environments, the DepEd adopted a distance learning approach using Self-Learning Modules (SLMs), available in printed and digital formats. However, these modules posed new challenges, and there were concerns about their effectiveness in teaching General Mathematics.

In addition to SLMs, other modalities, such as online learning through Learning Management Systems (LMS), asynchronous learning, radio-based instruction, and more, were employed to cater to different learning needs.

The rapid shift to these methods highlighted the need for teachers to adapt their instructional strategies to maintain educational quality during the pandemic (Jovanović et al., 2017). Despite these efforts, students struggled to understand some General Mathematics concepts.

Most existing studies have focused on the teaching strategies employed by educators during the pandemic, with less attention given to the learning strategies used by students (Sutarto et al., 2020). This research aims to fill that gap by exploring the strategies employed by Grade 12 students in Mabinay District 2 in learning mathematics. It also examines how the pandemic has altered students' learning styles and why it is important to consider factors such as sex, strand, and academic performance when investigating these strategies. The findings of this study could provide valuable insights into how learning strategies impact student performance and help develop targeted interventions to enhance learning outcomes, regardless of the ongoing challenges posed by the pandemic.

2.0 Methodology

2.1 Research Design

A descriptive-correlational research design is a non-experimental study that aims to describe the characteristics of a population or phenomenon and examine the relationships between variables without manipulating them. This design is particularly useful for understanding how variables naturally occur and interact within a specific context. By providing detailed descriptions and identifying patterns of relationships, it offers insights that can inform further research and practice. In this study, the descriptive-correlational design is appropriate because it allows for a detailed description of the extent of utilization of the strategies in learning General Mathematics and examines the relationships between these strategies and students' academic performance during the pandemic. This approach helps to understand the patterns and associations in the data, providing valuable insights into the factors that may influence learning outcomes without attempting to establish causality. The descriptive-correlational design effectively captures the natural variations and interactions between students' learning strategies and academic performance. Given the context of the COVID-19 pandemic, where traditional learning environments and methods have been disrupted, this design allows researchers to observe how students adapt their learning strategies in real-world settings. The study maintains ecological validity by not manipulating any variables and offers a realistic view of students' learning behaviors and outcomes.

2.2 Research Environment

The study was conducted in Mabinay District 2, Mabinay, Negros Oriental, focusing on the senior high school students from Campanun-an Provincial Community High School, Pantao National High School, and Tara Provincial Community High School. Mabinay District 2 was chosen for this research due to its diverse student population and the availability of various high schools that cater to different socioeconomic backgrounds. This diversity provides a comprehensive view of the strategies employed by students in learning General Mathematics, making the findings more generalizable to other similar educational settings.

Mabinay's educational institutions represent many rural areas in the Philippines, where students face unique challenges, such as limited access to resources and varying levels of instructional support. By selecting this district, the study aims to shed light on how these factors influence the learning strategies of senior high school students in General Mathematics. This setting is particularly relevant given the impact of the COVID-19 pandemic on education, as it provides insights into how students in rural and resource-constrained environments adapt their learning strategies in response to unprecedented disruptions.

2.3 Research Participants

The study's respondents were Grade 12 students from the Humanities and Social Sciences (HUMSS), TVL-Automotive, and TVL-Sugar Processing strands in Mabinay District 2 for the School Year 2022-2023. A systematic sampling technique was employed to select every nth individual in the population list to ensure a representative sample. In this study, every second student was chosen as a respondent. The inclusion criteria for selecting respondents included enrolling as a Grade 12 student in one of the specified strands during the designated school year and having complete academic records before and during the pandemic.

2.4 Research Instrument

To collect data, the researcher employed a self-constructed questionnaire and obtained copies of students' average grades in mathematics before and during the pandemic. The questionnaire comprised two sections: the first detailed the students' profiles, including sex, academic strand, and academic performance before and during the pandemic; the second focused on the strategies students used during the pandemic. The questions in the second part were based on the student's current academic situation and the strategies they implemented to improve their skills in General Mathematics during the pandemic. Additionally, the researcher reviewed relevant articles and publications on effective strategies for enhancing mathematical skills, incorporating key insights into the questionnaire. For content validity, the questionnaire was evaluated by three experts. To ensure reliability, a pilot test was conducted with 30 selected Tara Provincial Community High School students, who were not included in the main study sample.

The reliability of the questionnaire items was assessed using Cronbach's alpha, a measure appropriate for survey research where responses are not simply right or wrong. Cronbach's alpha values range from 0 to 1, with values above 0.70 indicating acceptable internal consistency and reliability (McMillan & Schumacher, 2001). The pilot test results indicated strong reliability coefficients: 0.796 for metacognitive strategies, 0.872 for cognitive strategies, and 0.901 for collaborative strategies. These values demonstrate a high level of internal consistency across the different strategy categories, confirming the reliability of the questionnaire for the main study.

2.5 Data Gathering Procedure and Analysis

Following the design hearing, the researcher implemented all corrections and suggestions provided by the panel members. Subsequently, a request letter to conduct the study was submitted to the Schools Division Superintendent of the Division of Negros Oriental, with an endorsement from the dean of Foundation University Graduate School. The signed request was presented to the school principals and the students' respective advisers upon approval. During the questionnaire distribution, the researcher explained the purpose of the study and its significance to the students. The questionnaires were collected immediately after completion. The data were then tallied using MS Excel and Megastat software for analysis and interpretation.

2.6 Ethical Considerations

The researcher meticulously adhered to all necessary ethical considerations throughout the study. Confidentiality was strictly maintained to protect the dignity and privacy of all participants. Comprehensive efforts were undertaken to minimize any potential risks. The study followed the ethical protocols stipulated by the Ethics Committee of Foundation University. Before conducting the study, the researcher sought and received permission from the appropriate authorities, ensuring full compliance with institutional and ethical guidelines.

3.0 Results and Discussion

3.1 Strategies Employed by the Students in Learning General Mathematics

Metacognitive Strategies

Table 1 presents the extent to which students employ metacognitive strategies in learning General Mathematics. It reveals that, generally, the students' extent of utilization of the metacognitive strategies is "high," as indicated by the composite value of 5.52. The students agreed they could read the instructions carefully before completing the learning tasks. This indicates that students are attentive to the instructions provided by their teachers. Additionally, comprehending the instructions beforehand facilitates the accurate and effective completion of tasks.

The table further indicates that students "highly" utilize their metacognitive strategies by (a) evaluating their abilities, (b) considering alternative approaches to solving tasks, (c) adjusting their learning pace and duration, (d) exploring all possible solutions before choosing a final one, (e) solving and comparing problems with previous examples, and (f) gathering relevant and up-to-date information about the lesson content. This indicates that students actively take control of their learning processes, leading to more effective problem-solving and a deeper understanding of lesson content. Consequently, fostering metacognitive strategies can enhance students' overall academic performance and adaptability in various learning contexts.

Table 1. Descriptive statistics of the extent to which students employ the metacognitive strategies in learning General Mathematics (n = 126)

Indicators		Mean	Interpretation	Extent
1.	Read the instructions carefully before I start answering my learning task.	6.23	Strongly Agree	Very High
2.	Evaluate my ability as a student to complete the learning tasks.	5.70	Agree	High
3.	Check my answers to see if there are other ways to solve a mathematical problem.	5.66	Agree	High
4.	Adjust my learning speed and duration based on the lesson's content.	5.63	Agree	High
5.	Determine whether I have gone for all other possibilities before selecting a final solution.	5.52	Agree	High
6.	I assess a problem and often compare it with the problems I have previously solved.	5.43	Agree	High
7.	Collect all the relevant and recent information about the lesson's content.	5.38	Agree	High
8.	Identify alternative ways of solving math problems.	5.25	Somewhat Agree	Somewhat High
9.	Complete my assignments and learning activities within the schedule.	5.21	Somewhat Agree	Somewhat High
10.	I follow a strict timetable when studying my math learning tasks.	5.18	Somewhat Agree	Somewhat High
Composite		**5.52**	**Agree**	**High**

Furthermore, the table reveals that the student's ability to (a) identify alternative ways to solve the problem, (b) complete assignments on time, and (c) follow a strict timetable for studying the learning tasks is "somewhat high." Doing assignments on time and following the timeframe in reviewing different learning tasks will help students not to procrastinate. The preceding results suggest that students can effectively assess their knowledge and enhance their learning. Moreover, students use metacognitive strategies extensively, particularly in tasks like careful reading of instructions, self-assessment of abilities, and exploring alternative problem-solving approaches. This indicates a keen awareness of task demands and efficient self-regulation in learning. Nevertheless, although students demonstrate moderate proficiency in time management and alternative problem-solving strategies, targeted support could further boost academic performance and reduce procrastination. These findings underscore the critical role of developing metacognitive skills to optimize learning outcomes in mathematics education. Anthonysamy (2021) highlighted that students employing metacognitive strategies can effectively evaluate their comprehension and improve their learning processes. Additionally, Uppal and Kumar (2020) emphasized that awareness of one's thinking enables effective regulation of learning. Furthermore, Nasution and Edy (2017), as cited by Simorangkir (2018), underscored that leveraging metacognitive skills empowers learners to manage the entire learning process, from planning through execution. Lastly, Muncer et al. (2022) identified a significant correlation between metacognitive abilities and students' mathematical performance, reinforcing the positive impact of these strategies on academic achievement in mathematics.

Cognitive Strategies

Table 2 shows the extent to which students employ cognitive strategies in learning General Mathematics. Overall, the data reveal a "high" utilization of cognitive strategies by the students in learning General Mathematics, with a composite mean of 5.51.

Table 2. Descriptive statistics of the extent to which students employ the cognitive strategies in learning General Mathematics (n = 126)

Indicators		Mean	Interpretation	Extent
1.	Apply my knowledge from my previous activities to my recent ones.	5.72	Agree	High
2.	Summarise all the lessons, formulas, and steps in solving a problem for me to have organized notes or references.	5.71	Agree	High
3.	Connect my prior knowledge to the new lessons or activities.	5.69	Agree	High
4.	Rather than just reading, Think through a topic and decide what I should learn from it.	5.67	Agree	High
5.	Determine which concepts I do not understand well.	5.61	Agree	High
6.	Study and outline the material to help me organize my thoughts.	5.55	Agree	High
7.	Go over my course notes and outline important concepts.	5.51	Agree	High
8.	Write summaries of different problems from my notes.	5.39	Agree	High
9.	Memorize the formulas and steps for solving math problems.	5.28	Somewhat Agree	Somewhat High
10.	Read my course notes and solve various math problems over and over again.	4.98	Somewhat Agree	Somewhat High
Composite		**5.51**	**Agree**	**High**

The data expose that students are "highly" capable of (a) applying their knowledge from previous activities to recent ones, (b) making a summary of the lessons, steps, and formulas to stay organized, (c) connecting prior knowledge to current lessons, (d) deciding what they are supposed to learn, (e) determining not well-understood

concepts, (f) outlining materials to stay organized, (g) outlining important concepts, and (h) writing summaries of different problems. The findings imply that students use their prior knowledge to understand new concepts and can distinguish concepts that need to be learned. Meanwhile, the table also exposes that the student's ability to (a) memorize the formulas and steps in solving math problems and (b) read their course notes and solve various math problems is "somewhat high." This signifies that the students are somewhat aware of the importance of having a list of important concepts and formulas that they can refer to in case problems in understanding new concepts arise.

The above results imply that the students can use their cognitive strategies in learning General Mathematics, as evidenced by their effective application of prior knowledge and organization of learning materials. This suggests a strong ability to connect and integrate new concepts with existing knowledge. However, while students demonstrate a somewhat high capability in memorizing formulas and problem-solving steps, there is room for improvement. These findings underscore the importance of enhancing cognitive strategies to optimize learning outcomes in mathematics education further.

Montague et al. (2014) emphasized that cognitive strategies significantly enhance students' mathematical learning. Zhu (2015) supported this by suggesting that cognitive strategies assist students, particularly those facing challenges in mathematics, in excelling academically. Moreover, Semeraro et al. (2020) identified overall cognitive ability as a critical predictor of success in mathematics achievement. Similarly, Sales (2024) highlighted the influential role of cognitive strategies in shaping students' mathematical learning experiences. These strategies enhance mathematical skills and enable effective self-assessment of performance. Furthermore, cognitive strategies facilitate learning by promoting essential skills such as reading comprehension, computation, and problem-solving. This collective evidence underscores the pivotal role of cognitive strategies in facilitating effective learning and mastery of mathematics.

Collaborative Strategies

Table 3 shows the extent to which students employ collaborative strategies in learning General Mathematics. Synthesizing the results, the data depicts that the students "highly" utilize the collaborative strategies, which is evident in the values of the composite mean of 5.73.

Table 3. Descriptive statistics of the extent to which students employ the collaborative strategies in learning General Mathematics (n = 126)

Indicators		Mean	Interpretation	Extent
1.	Look back and reflect on my responses with peers.	5.98	Agree	High
2.	Ask for assistance from my parents/ guardian/siblings when I need to.	5.88	Agree	High
3.	Ask for clarifications, examples about the materials, or verification about the task from my siblings, parents, guardians, and other relatives or neighbours who did finish their studies.	5.87	Agree	High
4.	Be in a group and discuss math problems to gain new techniques in solving the task.	5.82	Agree	High
5.	Ask for feedback from my adviser/subject teacher to guide me in completing my learning task.	5.78	Agree	High
6.	Ask for assistance from an individual/s who knows Mathematics or someone with a degree in math.	5.66	Agree	High
7.	Reduce my anxiety by using mental techniques that make me feel competent to do the learning task with peers.	5.62	Agree	High
8.	Do collaborative learning with friends/classmates face-to-face or online.	5.61	Agree	High
9.	Collaborate with classmates to discuss problems, share different approaches, and collectively find solutions to enhance our understanding and problem-solving skills.	5.58	Agree	High
10.	Work together with my classmates to solve the task during our free time.	5.48	Agree	High
Composite		**5.73**	**Agree**	**High**

The data indicate that the students are "highly" able to (a) look back and reflect on their responses with their peers, (b) seek assistance and clarifications about their tasks from family members and other individuals knowledgeable in math (c) be in group and discuss and learn math problems, (d) ask feedback from teachers, (e) use mental techniques to reduce anxiety, (f) do collaborative learning with peers, (g) provide personal motivation, and (h) work with classmates to solve tasks during free time.

The findings suggest that students effectively utilize collaborative strategies and social skills in learning General Mathematics. They share their knowledge of the subject and demonstrate a willingness to accept and seek

feedback and assistance from teachers, parents, and peers. This supportive network motivates students to engage more deeply in their learning. Algani (2021) emphasized that collaborative strategies foster a conducive learning environment, significantly enhancing students' motivation and ensuring effective learning. Similarly, Karlsson et al. (2021) found that cooperative learning notably improves students' problem-solving skills. Their study revealed that students with higher levels of social acceptance and strong friendships achieved better results in mathematical problem-solving tasks, highlighting that the quality of social interactions within the group is crucial for maximizing students' mathematical abilities.

Similarly, Warsah et al. (2021) demonstrated that collaborative learning significantly enhances students' critical thinking skills. Additionally, students reported that collaborative learning positively impacted their emotional awareness, learning motivation, cognitive development, and open-mindedness. Ridwan and Hadi (2022) also determined that cooperative learning significantly influences students' mathematics learning outcomes. Moreover, Møgelvang and Nyléhn (2023) revealed that incorporating collaborative learning elements significantly boosts students' academic performance. They found that students benefit from enhanced attitudes towards learning, improved generic skills, and better psychological health.

3.2 Academic Performance of the Students in General Mathematics

Table 4 shows the academic performance of the students in General Mathematics. The results indicate that Senior High School students' academic performance in General Mathematics is "Satisfactory," with an average rating of 83.94%.

Table 4. Academic performance of the students in General Mathematics (n = 126)

Rating	Verbal Description	Frequency	Percentage
90% - 99%	Outstanding	14	11.11
85% - 89%	Very Satisfactory	27	21.43
80% - 84%	Satisfactory	73	57.94
75% - 79%	Fairly Satisfactory	12	9.52
Mean = 83.94%	(Satisfactory)		
SD = 4.50			

The data shows that most students fall within the "Satisfactory" range, between 80% and 84%. Additionally, 21.43% of the students achieved a "Very Satisfactory" level, and 11.11% reached an "Outstanding" level. Conversely, 9.52% of the students were at the "Fairly Satisfactory" level. These findings suggest that most students have acquired fundamental knowledge and skills, developed core understanding, and can independently apply these abilities through authentic performance tasks (DepEd Order No. 8, s. 2015).

Padernal and Diego (2020) found that senior high school students exhibited average academic performance in mathematics, regardless of their school of origin or entrance examination scores. In parallel, Casinillo et al. (2020) emphasized that students' attitudes toward mathematics significantly shape their learning outcomes and academic achievements. Several factors substantially influence academic success, including parental education and income levels, availability of textbooks, access to libraries and practical laboratories, provision of meals, and the quality of teachers (Brew et al., 2021). Students with higher academic performance typically have greater exposure to these factors, underscoring their impact on educational outcomes. Conversely, Spitzer and Musslick (2021) reported an improvement in students' mathematical performance during the school shutdown in 2020 compared to the previous year. This improvement suggests that external conditions and learning environments can significantly influence students' academic performance.

3.3 Relationship Between the Strategies Employed by the Students and Their Academic Performance

Table 5 presents the data examining the correlation between students' employed strategies and academic performance. The results indicate that all p-values exceed the predetermined significance level of (0.05). Consequently, there is insufficient evidence to reject the null hypothesis, suggesting that students' strategies during the pandemic have no significant impact on their academic performance. This observation can be attributed to the widespread effects of the pandemic, as individuals are still undergoing significant adjustment. The disruptions caused by the pandemic likely reduced the effectiveness of these strategies. Therefore, it

highlights the need for educational systems to adopt broader, more holistic approaches to support student learning and adjustment during such unprecedented times.

Table 5. Analysis for the relationship between the strategies employed by the students and their academic performance (n = 126)

Variables Correlated to Academic Performance	r_s	p-value	Decision	Remark
Metacognitive Strategies	0.092	0.305	Fail to reject H_{o1}	Not significant
Cognitive Strategies	0.136	0.129	Fail to reject H_{o1}	Not significant
Collaborative Strategies	0.008	0.982	Fail to reject H_{o1}	Not significant

Level of significance = 0.05

Neroni et al. (2019) highlighted that effective time and effort management emerged as crucial factors positively influencing academic performance in modular distance learning. Moreover, Gomes et al. (2020) emphasized the importance of individual, school, and family-related factors in predicting mathematics achievement. Their study identified how personal attributes, educational environment, and family background collectively influence students' performance in mathematics. However, Güner and Erbay (2021) found that metacognitive skills are crucial to students' problem-solving success. Students with solid metacognitive skills are good at solving problems correctly by choosing the right strategies, using mathematical notations properly, and applying logical reasoning. On the other hand, students with weak metacognitive skills face difficulties in understanding the problem, picking the right strategies, and finding the correct answers. These findings highlight the importance of metacognitive skills in improving students' problem-solving abilities in mathematics.

3.4 Difference in the Strategies Employed by the Students in Learning General Mathematics when Grouped According to Their Profile

Table 6 presents the results of the statistical analyses conducted to examine differences in employing the strategies based on the students' profiles.

Table 6. Analysis for the difference in the strategies employed by the students when grouped according to their profile (n = 126)

Variables	N	Mean Rank	Median	U-value	p-value	Decision	Remark
Sex							
Male	54	63.6	5.67	1939	0.984	Fail to reject H_{o2}	Not significant
Female	72	63.4	5.65				
Variables	**N**	**Mean Rank**	**Median**	**H-Value**	**p-value**	**Decision**	**Remark**
Strand							
HUMSS	95	65.5	5.67				
TVL Automotive	16	46.2	5.22	4.24	0.120	Fail to reject H_{o2}	Not significant
TVL Sugar Processing	15	69	5.85				
Academic Standing Before the Pandemic							
(1) Outstanding	8	99.8	6.33	9.18	0.027		Significant
(2) Very Satisfactory	20	66.5	5.68				
(3) Satisfactory	55	61.5	5.65				
(4) Fairy Satisfactory	43	58.0	5.57				
		Post Hoc Analysis					
		(1) vs (2): p = 0.039 (not significant)					
		(1) vs (3): p = 0.003 (significant)					
		(1) vs (4): p = 0.008 (significant)					
		(2) vs (3): p = 0.596 (not significant)					
		(2) vs (4): p = 0.412 (not significant)					
		(3) vs (4): p = 0.569 (not significant)					

Mann-Whitney U Test and Kruskal Wallis Test (H) at 0.05 Level of significance with Bonferroni correction (0.05/6 =0.008)

Using the Mann-Whitney U Test for sex and Kruskal Wallis Test for strand, these results are revealed: ($p = 0.984 > \alpha = 0.05$) for sex and ($p = 0.120 > \alpha = 0.05$) for strand. This means that there is no significant difference in the strategies employed by the students when grouped according to their sex and strand. Lanuza et al. (2022) discovered no notable disparity in the use of learning strategies in learning mathematics when students are categorized according to sex. However, Zhao et al. (2022) identified subtle distinctions in cognitive development and the consistent adoption of preventive behaviors between genders. In addition, Dweck and Yeager (2019) noted

that mindsets can define a person's subjective beliefs about whether a particular attribute, such as intelligence, is fixed or can be shaped and developed based on gender.

Using the Kruskal-Wallis Test, it was determined that a significant difference ($p = 0.027 < \alpha = 0.05$) occurs in how students employ strategies when categorized based on their academic performance before the pandemic. To test which group or group of students has a higher extent of utilization of strategies, a post hoc analysis was applied using the Mann-Whitney U test with Bonferroni correction (adjusted $\alpha = 0.008$). Findings reveal that (a) students with exceptional pre-pandemic academic standing exhibit greater strategy utilization than those with satisfactory ratings, and (b) students with outstanding pre-pandemic academic standing employ strategies more extensively than those with satisfactory ratings. Similar levels of strategy utilization were observed among the remaining groups in learning General Mathematics. The non-parametric test is used since the variable (strategies employed) is measured on an ordinal scale, and the data are not normally distributed.

Kim et al. (2023) conducted an in-depth analysis of various self-regulation strategies, including cognitive and metacognitive techniques, to understand their influence on academic performance. The study concluded that students who achieve higher academic results are more adept at employing these self-regulation strategies effectively. This suggests a significant correlation between the strategic use of cognitive and metacognitive techniques and superior academic performance, emphasizing the importance of these strategies in academic success. Additionally, Darkwa and Antwi (2021) disclosed that before the pandemic, teaching and learning strategies were more effective than during the pandemic.

3.5 Difference in the Academic Performance of the Students when Grouped According to Their Profile

Table 7 shows the results of the statistical analyses conducted to examine differences in the student's academic performance when grouped according to their profile.

Table 7. Analysis for the difference in the academic performance of the students when grouped according to their profile (n = 126)

Variables	N	Mean	t-value	p-value	Decision	Remark
Sex						
Male	54	82.72	2.703	0.008	Reject H_{o2}	Significant
Female	72	84.86				
Strand						
HUMSS	95	84.11	0.89	0.413	Fail to reject H_{o2}	Not significant
TVL Automotive	16	82.56				
TV Sugar Processing	15	84.40				
Academic Standing Before the Pandemic						
(5) Outstanding	8	93.63	28.69	0.000	Reject H_{o2}	Significant
(6) Very Satisfactory	20	86.35				
(7) Satisfactory	55	83.09				
(8) Fairy Satisfactory	43	82.12				
	Post Hoc Analysis					
	(1) vs (2): p = 0.000 (significant)					
	(1) vs (3): p = 0.000 (significant)					
	(1) vs (4): p = 0.000 (significant)					
	(2) vs (3): p = 0.027 (significant)					
	(2) vs (4): p = 0.002 (significant)					
	(3) vs (4): p = 0.831 (not significant)					

t-test and ANOVA at a 5% level of significance

The data reveals a significant difference ($p = 0.008 < \alpha = 0.05$) in the performance of the male and female students in favor of the latter group. This suggests that gender may influence academic outcomes. Xie et al. (2023) observed that female students generally receive higher ratings, experience lower levels of mathematical anxiety, display greater interest in the subject, and exhibit higher confidence in math classes than their male counterparts. Contrarily, Capinding (2022) reported no significant differences between male and female students regarding their overall academic performance. In contrast to these findings, Rodriguez et al. (2020) highlighted gender disparities in primary education, particularly in Mathematics self-concept, self-efficacy, and interest. Their study indicates boys often demonstrate more favorable motivational profiles in mathematics than girls.

It is also reflected that using ANOVA, no significant difference ($p = 0.413 > \alpha = 0.05$) exists in the students' performances when grouped according to their strands. This may connote that the performances of these students

in HUMMS, TVL Automotive, and TVL Sugar Processing do not vary. This finding suggests that the academic strand a student belongs to does not play a crucial role in influencing their academic outcomes, indicating that different strands do not cater to varied academic strengths and aptitudes among students. A parametric statistical tool is used since the variable (academic performance) is measured on a ratio scale, and the data are normally distributed. The finding opposes the claim of Alova and Alova (2022) that students who belong to the academic strand perform better than students from the TVL strand. In addition, Almerino et al. (2020) demonstrated a significant variation in students' academic performance when analyzed according to their respective academic strands.

Furthermore, the data divulge that there is a significant difference ($p = 0.000 < \alpha = 0.05$) in the performances of the students when grouped according to their academic standing before the pandemic. To test which group is better than the other, a post hoc analysis (Tukey HSD Test) was applied. It reveals that (a) students who were outstanding before the pandemic are better than those who are classified as very satisfactory, satisfactory, and fairly satisfactory; and (b) students who are categorized as very satisfactory before the pandemic are better than those who are labeled as satisfactory and fairly satisfactory. Nevertheless, no significant difference exists between those students who are identified as satisfactory and those who are categorized as fairly satisfactory. Blomberg et al., as cited by Saya-ang (2023), pointed out that prior performance is a powerful prerequisite for learning outcomes and mathematical performance. Additionally, Zakariya et al. (2023) highlighted the beneficial impact of prior mathematics knowledge on students' academic performance. Their findings underscore the importance of a solid foundation in mathematics as a significant predictor of future success in the subject. Furthermore, Kania et al. (2023) revealed that a strong mathematical background correlates positively with enhanced critical thinking skills within the discipline.

4.0 Conclusions

In exploring the use of metacognitive, cognitive, and collaborative strategies in learning General Mathematics during the pandemic, this study reveals that while students can employ these strategies, their utilization is suboptimal, resulting in average academic performance. External factors, such as students' physical and emotional conditions during questionnaire administration, likely influenced these outcomes. The challenges of adapting to remote learning and pandemic-related disruptions further impeded students' full engagement with these strategies. Factors like stress, anxiety, fatigue, distractions, and inadequate study environments may have compromised their effectiveness.

Notably, students who previously struggled with mathematics faced heightened difficulties in independent learning due to insufficient foundational knowledge for grasping advanced concepts. This underscores the necessity for tailored interventions to address these specific needs. By enhancing strategy utilization and mitigating these challenges, there exists the potential to improve academic outcomes and enrich the overall Mathematics learning experience, especially during crises like the pandemic.

This suggests that educators and policymakers should consider personalized interventions, such as targeted tutoring and improved learning environments, to better support students. This would also highlight the need for future researchers to integrate variables like stress and learning contexts to enhance understanding of strategy effectiveness. However, this study acknowledges limitations, including uncontrollable external factors, which necessitate cautious interpretation of results. Future researchers may consider investigating additional influences on learning outcomes, such as socioeconomic status and parental support, through longitudinal studies and experimental research aimed at optimizing strategy use across diverse learning settings.

5.0 Contributions of Authors

This study has a single author and his adviser reviewed and approved the final version of this paper.

6.0 Funding

This research is not funded by any funding agency.

7.0 Conflict of Interests

The author declared that he has no conflicts of interest as far as this study is concerned.

8.0 Acknowledgment

The author expresses deep gratitude to his adviser, the statistician, and Foundation University for their invaluable collaboration and support. Their insightful suggestions and guidance were crucial in making this research paper possible.

9.0 References

Abd Algani, Y. M. (2021). The effect of the collaborative learning technique on students' educational performance in math. Journal for the Mathematics Education and Teaching Practices, 2(2), 93-103.

Almerino Jr, P. M., Ocampo, L. A., Abellana, D. P. M., Almerino, J. G. F., Mamites, I. O., Pinili, L. C., & Peteros, E. D. (2020). Evaluating the academic performance of K-12 students in the Philippines: A standardized evaluation approach. Education Research International, 2020(1), 8877712. doi:10.1155/2020/8877712

Alova, C. A. R., & Calanza-Alova, I. M. (2022). Academic performance in general mathematics of grade 11 students: A brief report. Online Submission. doi:10.13140/RG.2.2.31975.11685

Anthonysamy, L. (2021). The use of metacognitive strategies for undisrupted online learning: Preparing university students in the age of pandemic. Education and Information Technologies, 26(6), 6881-6899.

Brew, E. A., Nketiah, B., & Koranteng, R. (2021). A literature review of academic performance, an insight into factors and their influences on academic outcomes of students at senior high schools. Open Access Library Journal, 8(6), 1-14. doi:0000-0002-6516-5725

Busuttil, L., & Camilleri, R. (2020). Teachers' response to the sudden shift to online learning during COVID-19 pandemic: Implications for policy and practice. Retrieved from ResearchGate

Cahapay, M. B. (2020). Philippine basic education learning continuity plan: Creating space for indigenous peoples toward inclusive post-COVID-19 education. International Journal of Pedagogical Development and Lifelong Learning, 2(1). doi:10.30935/ijpdll/9294

Capinding, A. T. (2022). Impact of modular distance learning on high school students' mathematics motivation, interest/attitude, anxiety, and achievement during the COVID-19 pandemic. European Journal of Educational Research, 11(2), 917-934.

Casinillo, L., Palen, M., Casinillo, E., & Batidor, P. (2020). Assessing senior high students' learning experiences in mathematics. Indonesian Journal of Educational Studies, 23(1).

Darkwa, B. F., & Antwi, S. (2021). From classroom to online: Comparing the effectiveness and student academic performance of classroom learning and online learning. Open Access Library Journal, 8(7), 1-22. doi:10.4236/oalib.1107597

Department of Education. (2015). DepEd Order No. 8, series of 2015: Policy guidelines on classroom assessment for the K to 12 basic education programs.

Department of Education. (2020). DepEd Order No. 12, series of 2020: Adoption of the basic education learning continuity plan for the school year 2020-2021 in light of the COVID-19 public health emergency.

Gomes, C. M. A., Fleith, D. D. S., Marinho-Araujo, C. M., & Rabelo, M. L. (2020). Predictors of students' mathematics achievement in secondary education. Psicologia: Teoria e Pesquisa, 36, e3638. doi:10.1590/0102.3772e3638

Güner, P., & Erbay, H. N. (2021). Metacognitive skills and problem-solving. International Journal of Research in Education and Science, 7(3), 715-734. doi:10.46328/ijres.1594

Jameel, H. T., Ali, H. H., & Phil, M. (2016). Causes of poor performance in mathematics from teachers, parents, and students' perspective. American Scientific Research Journal for Engineering, Technology, and Sciences, 15(1), 122-136. Retrieved from asrjetsjournal.org

Jovanović, J., Gašević, D., Dawson, S., Pardo, A., & Mirriahi, N. (2017). Learning analytics to unveil learning strategies in a flipped classroom. The Internet and Higher Education, 33(4), 74-85. doi:10.1016/j.iheduc.2017.02.001

Kania, N., Fitriani, C., & Bonyah, E. (2023). Analysis of students' critical thinking skills based on prior knowledge mathematics. International Journal of Contemporary Studies in Education, 2(1). doi:10.30880/ijcse.v2i1.248

Kim, Y. E., Zepeda, C. D., & Butler, A. C. (2023). An interdisciplinary review of self-regulation of learning: Bridging cognitive and educational psychology perspectives. Educational Psychology Review, 35(3), 92. doi:10.1007/s10648-023-09800-x

Klang, N., Karlsson, N., Kilborn, W., Eriksson, P., & Karlberg, M. (2021, August). Mathematical problem-solving through cooperative learning—the importance of peer acceptance and friendships. In Frontiers in Education (Vol. 6, p. 710296). Frontiers. doi:10.3389/feduc.2021.710296

Lanuza, M. H., Hilario, F. F., Arroyo, A. M., & Lara, M. N. (2022). Gallery walk: The strategy in improving mathematics performance of the SHS in different strands of K to 12. World Wide Journal of Multidisciplinary Research and Development, 8(09), 5-13.

Møgelvang, A., & Nyléhn, J. (2023). Co-operative learning in undergraduate mathematics and science education: A scoping review. International Journal of Science and Mathematics Education, 21(6), 1935-1959. doi:10.1007/s10763-022-10331-0

Montague, M., Krawec, J., Enders, C., & Dietz, S. (2014). The effects of cognitive strategy instruction on math problem solving of middle-school students of varying ability. Journal of Educational Psychology, 106(2), 469. doi:10.1037/a0035176

Muncer, G., Higham, P. A., Gosling, C. J., Cortese, S., Wood-Downie, H., & Hadwin, J. A. (2022). A meta-analysis investigating the association between metacognition and math performance in adolescence. Educational Psychology Review, 34(1), 301-334. doi:10.1007/s10648-021-09620-x

Neroni, J., Meijs, C., Gijselaers, H. J., Kirschner, P. A., & de Groot, R. H. (2019). Learning strategies and academic performance in distance education. Learning and Individual Differences, 73, 1-7. doi:10.1016/j.lindif.2019.04.007

Padernal, R. E., & Diego, C. V. (2020). Academic performance of senior high school students in pre-calculus. Philippine Social Science Journal, 3(2), 69-70. doi:0000-0002-6516-5725

Ridwan, M. R., & Hadi, S. (2022). A meta-analysis study on the effectiveness of a cooperative learning model on vocational high school students' mathematics learning outcomes. Participatory Educational Research, 9(4), 396-421. doi:10.17275/per.22.97.9.4

Rodriguez, S., Regueiro, B., Piñeiro, I., Estévez, I., & Valle, A. (2020). Gender differences in mathematics motivation: Differential effects on performance in primary education. Frontiers in Psychology, 10, 3050. doi:10.3389/fpsyg.2019.03050

Sales, S. L. T. (2024). Dimensionality of strategies in learning mathematics among engineering students: An exploratory factor analysis. TWIST, 19(1), 445-453. doi:10.5281/zenodo.10049652#111

Saya-ang, R. (2023). Blended learning approach: Its effectiveness in teaching.

Semeraro, C., Giofrè, D., Coppola, G., Lucangeli, D., & Cassibba, R. (2020). The role of cognitive and non-cognitive factors in mathematics achievement: The importance of the quality of the student-teacher relationship in middle school. PLOS ONE, 15(4), e0231381.

Simorangkir, D. (2018). The effect of online learning on students' metacognitive ability in mathematics learning. Retrieved from ResearchGate

Spitzer, M. W. H., & Musslick, S. (2021). Academic performance of K-12 students in an online-learning environment for mathematics increased during the shutdown of schools in wake of the COVID-19 pandemic. PLOS ONE, 16(8), e0255629. doi:10.137/journal.pone.0255629

Sutarto, S., Sari, D. P., & Fathurrochman, I. (2020). Teacher strategies in online learning to increase students' interest in learning during COVID-19 pandemic. Jurnal Konseling Dan Pendidikan, 8(3), 129-137. doi:10.29210/147800

Uppal, N., & Kumar, A. (2020). Promoting metacognitive learning strategies: A necessity during pandemic. DRSR, 10(11), 30-5. Retrieved from ResearchGate

Warsah, I., Morganna, R., Uyun, M., Afandi, M., & Hamengkubuwono, H. (2021). The impact of collaborative learning on learners' critical thinking skills. International Journal of Instruction, 14(2), 443-460.

Xie, F., Yang, Y., & Xiao, C. (2023). Gender-math stereotypes and mathematical performance: The role of attitude toward mathematics and math self-concept. European Journal of Psychology of Education, 38(2), 695-708. doi:10.1007/s10212-022-00631-y

Zakariya, Y. F., Nilsen, H. K., Bjørkestøl, K., & Goodchild, S. (2023). Analysis of relationships between prior knowledge, approaches to learning, and mathematics performance among engineering students. International Journal of Mathematical Education in Science and Technology, 54(6), 1015-1033. doi:10.1080/0020739X.2021.1984596

Zhao, Y., Ding, Y., Shen, Y., & Liu, W. (2022). Gender difference in psychological, cognitive, and behavioral patterns among university students during COVID-19: A machine learning approach. Frontiers in Psychology, 13, 772870. doi:10.3389/fpsyg.2022.772870

Zhu, N. (2015). Cognitive strategy instruction for mathematical word problem-solving of students with mathematics disabilities in China. International Journal of Disability, Development and Education, 62(6), 608-627. doi:10.1080/1034912X.2015.1077935.