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THE MEDIATING EFFECT OF METACOGNITIVE THINKING SKILLS ON THE RELATIONSHIP BETWEEN ACADEMIC MOTIVATION AND ATTITUDE TOWARDS MATHEMATICS

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ABSTRACT
This research aimed to investigate mediating effect of metacognitive thinking skills on the relationship between academic motivation and attitude towards mathematics. The respondents were Grade 11 students drawn out from the total population using stratified random sampling. To collect the relevant data, three adapted survey questionnaires were administered to the respondents to measure the level of academic motivation, metacognitive thinking skills, and attitude towards mathematics. The results of the study showed high level of academic motivation and metacognitive thinking skills while the level of attitude towards mathematics was very high. The results further revealed a positive weak relationship on academic motivation, metacognitive thinking skills, and attitude towards mathematics. Furthermore, metacognitive thinking skills fully mediate the relationship between academic motivation and attitude towards mathematics.

KEYWORDS: *Education, Mathematics, Academic Motivation, Metacognitive Thinking Skills, Attitude Towards Mathematics, Grade 11, Descriptive Correlation, Philippines*

INTRODUCTION

Attitude refers to the predetermined disposition of individuals to respond favorably or unfavorably towards an object, circumstance, concept, or another individual (Sarmah & Puri, 2014). Specifically, attitude towards mathematics refers to an individual's predisposition towards a mathematical task, shaped by their cognitive, emotional, or behavioral responses (de la Peña et al., 2021). Recent studies showed that students' attitude in learning mathematics is declining and as a result has become a worldwide educational concern for many years including Pakistan (Shah et al., 2023), United States (Aguilar, 2021), Tanzania (Mazana et al., 2019), and Malaysia (Davadas & Lay, 2020). In learning mathematics, there is an increase in students' disinterest, indifference, and negative attitudes towards mathematics particularly among secondary students (Mazana et al., 2019; Wen & Dube, 2022; Pokhrel & Poudel, 2024).

In Singapore, the study of Hwang and Son (2021) revealed that among 4, 853 students, 5.44 percent have very negative level of attitude towards mathematics, 41.38 percent have a negative attitude, while the remaining students have a neutral to positive attitude towards the subject. On the other hand, Ortiz (2023) revealed that students enrolled in developmental mathematics courses from community colleges in Texas showed low attitude towards mathematics specifically in self-confidence, interest, and persistence. Meanwhile, Wen and Dube (2022) observed that less than one-third of 15-year-old students in many countries have a positive attitude towards mathematics reflecting that majority of students have negative attitude towards mathematics.

In Malolos, Philippines, a study showed that 75 percent of students in Mathematics 7 class expressed negative attitude towards mathematics class entailing that the students experience disinterest and boredom (Salamoding, 2016). Students of Bachelor of Elementary Education in Catanduanes City showed low attitude regarding mathematics and despite knowing that the subject helps them develop critical thinking, they still do not like mathematics and consider it as their least favorite subject (Subia et al., 2018).

Numerous studies have focused on investigating student mathematical attitude using different research methodologies including qualitative method (Jusra & Iskandar, 2020), mixed methods approach (Wakhata et al., 2022), and quantitative research method (Ceballos-Bejarano et al, 2023). Moreover, some studies associated attitude towards mathematics with various variables including lack of confidence (Aguilar, 2021), mathematics anxiety (Chaman & Callingham, 2013), insufficient qualifications of guardians and unpleasant home environments (Mahapatra & Sahoo, 2022), social discrimination, a deficiency of trained educators, and an absence of teaching materials and essential physical facilities (Poudel, 2020). It was also found out that age and gender (Imoro et al., 2019) and student achievement (Ortiz, 2023; Mazana et al., 2019) are associated with mathematical attitude of students. However, only a few studies have investigated the relationship between academic motivation and metacognitive thinking skills (Arslan, 2021; Tian et al., 2018). Moreover, studies which focused on attitude towards mathematics are only

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focused on specific population and while such preliminary evidence from attitudinal research is informative, few have focused about Grades 11 and 12 students because most of the local research have been concerned primarily with K to 10 and college (Cerbito, 2020; Karabyik, 2020; Pokhrel & Poudel, 2024).

Despite comprehensive research examining numerous factors affecting students' attitudes towards mathematics, a notable gap persists in the literature concerning the specific influence of academic motivation and metacognitive thinking skills on students' attitudes towards the subject as well as the relationship between academic motivation and metacognitive thinking skills in mathematics. While some studies linked attitude towards mathematics with either academic motivation or metacognitive thinking skills, the researcher has not encountered any studies regarding the relationship between academic motivation, metacognitive thinking skills, and attitudes toward mathematics. Moreover, existing studies have predominantly concentrated on lower grade levels and college levels rather than on higher levels of secondary education, particularly Grade 11 whose curriculum involves mathematics subjects for the entire school year. The researcher recognized the necessity to conduct a study given the identified gaps in the literature focusing on the relationship between academic motivation, metacognitive thinking skills, and attitude towards mathematics among public schools Grade 11 students in Santa Maria, Davao Occidental that aimed to determine the mediating effect of metacognitive thinking skills on the relationship between academic motivation and attitude towards mathematics.

The results of this study may significantly benefit schools, educators, administrators, and particularly in shaping the attitudes of public school Grade 11 students towards mathematics. The correlation between student attitude and factors such as academic motivation and metacognitive thinking skills could aid institutions, including public secondary schools, in maintaining a positive student attitude towards mathematics. Additionally, it may help students introduce the level of motivation so that they will become more willing and able to maintain positive predisposition in mathematics

STATEMENT OF THE PROBLEM

This study determined the mediating effect of metacognitive thinking skills on the relationship between academic motivation and attitude towards mathematics among public school Grade 11 students in Santa Maria, Davao Occidental. Specifically, it sought answers to the following questions:

1. What is the level of academic motivation in terms of:
    1.1 knowledge;
    1.2 accomplishment;
    1.3 stimulation;
    1.4 identified regulation;
    1.5 introjected regulation;
    1.6 extrinsic regulation; and
    1.7 amotivation?
2. What is the level of metacognitive thinking skills in terms of:
    2.1 thinking skills;
    2.2 reflective thinking skills towards problem-solving;
    2.3 decision making skills; and
    2.4 alternative skills of evaluation?
3. What is the level of attitude towards mathematics in terms of:
    3.1 negative attitude towards mathematics;
    3.2 tendency to avoid mathematics; and
    3.3 positive attitude towards mathematics?
4. Is there a significant relationship between:
    4.1 academic motivation and student attitude towards mathematics;
    4.2 academic motivation and metacognitive thinking skills; and
    4.3 metacognitive thinking skills and student attitude towards mathematics?
5. Do academic motivation and metacognitive thinking skills influence attitude towards mathematics?
6. Does metacognitive thinking skills mediate the relationship between academic motivation and attitude towards mathematics?

METHODS

This study employed a quantitative research approach, specifically a descriptive-correlational design, utilizing adapted questionnaires to collect the necessary data from respondents. The respondents of this study were 251 Grade 11 public school students from Santa Maria, Davao Occidental selected through stratified random sampling using Raosoft sample size calculator. Only students who took up General Mathematics during the first semester of the school year 2024 – 2025 and are bona fide students from the four secondary schools of Santa Maria, Division of Davao Occidental were included in the study. To gather the necessary data, the researcher utilized adapted survey questionnaires from published research available online and the survey is composed of three parts namely, Academic Motivation Scale developed by Utvaer and Haugan (2016), Metacognitive Thinking Skills Scale developed by Tuncer and Kaysi (2013), and Attitudes Toward Mathematics Scale developed by Bosco et al. (2022). The three questionnaires underwent expert validation and were subjected to pilot testing after incorporating all the suggestions of the experts. Content validity was ensured through expert review, while reliability was tested using Cronbach's alpha, confirming the consistency of the instruments. Each instrument used a Likert scale. A pilot test confirmed the instruments' reliability, yielding a Cronbach's alpha of 0.62 for academic motivation, 0.86 for metacognitive thinking skills, and 0.89 for the attitude towards mathematics.

RESULTS AND DISCUSSION

Level of Academic Motivation among Public School Grade 11 Students

Shown in Table 1 is the level of academic motivation of Grade 11 public school students. The category mean of amotivation were reversed. It was revealed that the overall mean is 5.30 which is interpreted as high. This indicates that the academic motivation of the Grade 11 students is oftentimes evident. This implies that the students are highly motivated in learning mathematics, and in general, they experience pleasure in learning new concepts in mathematics, experience a sense of accomplishment and believe that mathematics is helpful. In

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addition, the table also shows that the overall standard deviation is 0.67 which is less than one implying that the students' consistency of responses about academic motivation varies marginally.

The finding of high level of academic motivation among students supports the study of Anh (2021) who observed high levels of academic motivation in mathematics among students. Similarly, Okigbo and Odiri (2023) highlighted the high level of academic motivation among students which lead them to gain deeper understanding of mathematics and better achievement in mathematics.

Table 1
Level of Academic Motivation of Grade 11 Students

	Mean	SD	Description
Knowledge			
Being motivated in math class because they are …			
1. experiencing pleasure and satisfaction while learning new things.	5.31	1.32	High
2. finding pleasure in discovering new things never seen before.	5.39	1.26	High
3. finding pleasure broadening their knowledge about subjects which appeal to them.	5.17	1.17	High
4. learning continually about many things that interest them.	5.82	1.33	Very High
Category Mean	**5.42**	**0.95**	**High**
Accomplishment			
Being motivated in Math class because they are …			
1. experiencing pleasure while surpassing themselves in their studies.	5.33	1.23	High
2. finding pleasure when they are surpassing themselves in one of their personal accomplishments.	5.27	1.11	High
3. feeling satisfied when they are in the process of accomplishing difficult academic activities.	5.56	1.25	High
4. experiencing a personal satisfaction in their quest for excellence in their high school studies	5.38	1.13	High
Category Mean	**5.39**	**0.88**	**High**
Stimulation			
Being motivated in Math class because they are			
1. thinking school is fun for them	5.36	1.45	High
2. finding pleasure when they are having interesting discussions with their teachers.	5.45	1.21	High
3. feeling high while reading about various interesting subjects.	5.25	1.10	High
Category Mean	**5.36**	**0.99**	**High**
Identified Regulation			
Being motivated in Math class because they are			
1. thinking that a high-school education will help them better prepare for the career they have chosen.	6.00	1.16	Very High
2. eventually enabling them to enter the job market in a field that they like.	5.24	1.25	High
3. helping them make a better choice regarding their career orientation.	5.75	1.13	High
4. wanting to show themselves that they can succeed in their studies.	5.93	1.15	Very High
Category Mean	**5.69**	**1.04**	**High**
Introjected Regulation			
Being motivated in Math because they are …			
1. proving to themselves that they can complete their high-school degree.	5.78	1.13	High
2. having the reason that when they succeed in school they will feel important.	5.57	1.36	High
3. showing themselves that they are intelligent person.	4.78	1.46	High
4. wanting to show themselves that they can succeed in their studies.	5.76	1.18	High
Category Mean	**5.47**	**0.93**	**High**
Extrinsic			
Being motivated in Math because they are …			
1. needing at least a high-school degree to find a high-paying job later.	5.41	1.39	High
2. obtaining a more prestigious job later	5.41	1.28	High
3. wanting to have good life later	5.99	1.30	Very High
4. considering having a better salary later.	5.86	1.32	Very High

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Category Mean	**5.69**	**1.06**	**High**
Amotivation			
In Math, they …			
1. once had good reasons for going to school; however, now they are wondering whether they should continue.*	4.90	1.66	High
2. could not see any more why they go to school and frankly they care less *	3.78	1.68	Moderate
3. could not understand what they are doing in school *	3.41	1.76	Moderate
Category Mean*	**4.03**	**1.43**	**Moderate**
Overall Mean	**5.30**	**0.67**	**High**

Note: * Reversed before computing the category mean and the overall mean

Level of Metacognitive Thinking Skills among Public School Grade 11 Students

Table 2 presents the level of metacognitive thinking skills of Grade 11 students. The level of metacognitive thinking skills reflects an overall mean of 3.79 described as high which means that the metacognitive thinking skills of the Grade 11 students is oftentimes demonstrated. This indicates that the students have awareness about their own cognitive processes and use this awareness or information to monitor those same processes. Specifically, the students are capable of planning, monitoring, evaluating, and improving their learning processes. Additionally, Table 2 shows that the overall standard deviation is 0.34 which is less than one denoting that the high level of metacognitive thinking skills is consistent among students.

The finding of high metacognitive thinking skills among students is like the results of various studies. For instance, Icamina (2023) found high level of metacognitive thinking skills in mathematics among industrial technology students. She found out that the students are aware of their thinking strategies, they can employ different strategies or tactics in solving problems depending on the situation, and they can evaluate the effectiveness of their strategies. Similarly, the findings support the results of the study by Wang et al. (2022) which emphasized that students with high metacognitive can monitor their learning, have knowledge about the tasks and learning strategies. This also results in students having high efficiency in learning mathematics. Although students read the same problem statement, it was observed that students with high metacognitive thinking skills expressed the problem more by using their own sentences highlighting their capability of understanding the tasks and finding other strategies of solving it (Bal & Doganay, 2022).

Table 2
The Level of Metacognitive Thinking Skills of Public School Grade 11 Students

	Mean	SD	Description
Thinking Skills			
In Math class, they are…			
1. creating samples to make knowledge more meaningful.	3.95	.82	High
2. trying different working methods to obtain the best solution.	3.83	.91	High
3. thinking of what they will need to learn the task before beginning a new task.	3.89	.79	High
4. learning better due to their previous knowledge.	3.68	.89	High
5. repeating significant points to assure that they have learned it after they completed their task.	3.85	.87	High
Category Mean	**3.83**	**.61**	**High**
Reflective Thinking Skills Towards Problem Solving			
In Math class, they are …			
1. thinking if they could find a better way after solving a problem	3.79	.81	High
2. asking questions to themselves to find different ways of solving problems,	3.73	.91	High
3. asking questions to themselves to understand why they cannot solve it when they cannot solve a problem.	3.75	.93	High
4. comparing their results with their friends' result and evaluate the solution after they solve a problem.	3.65	1.05	High
5. thinking of similar problems that they solved before and making connections concerning the differences between the new problem and the old ones when they read a problem	3.70	.87	High
Category Mean	**3.72**	**.62**	**High**
Decision Making			
In Math class, they are thinking…			
1. about how their decisions can affect others.	3.79	.81	High
2. of the consequences of their decision.	3.73	.91	High
3. of options before they decide.	3.75	.93	High

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4.	carefully what, how and to whom their decision will address before they make a decision,.	3.65	1.05	High
	Category Mean	**3.70**	**.87**	**High**
Alternative Skills of Evaluation				
	In Math class, they are…			
1.	being aware of thinking technique or strategies concerning the topic they are working on.	3.75	.84	High
2.	being aware how their thinking mechanism works.	3.73	.78	High
3.	correcting their errors.	3.84	.87	High
4.	changing their thinking technique or strategy of their work when necessary	3.78	.84	High
	Category Mean	**3.77**	**.60**	**High**
	Overall Mean	**3.79**	**.47**	**High**

Level of Attitude Towards Mathematics among Public School Grade 11 Students

In Table 3, the level of attitude towards mathematics of Grade 11 public school students is presented. It shows an overall mean of 3.47 which is described as very high implying that the positive attitude towards mathematics of Grade 11 students is always manifested. Moreover, the overall standard deviation is .15 denoting that responses of the respondents are closer to the mean. The results also indicate that the students show interest in learning mathematics, getting high marks because they like the subject, discussing it with others, using their free time to study mathematics. In general, the students have positive predisposition towards mathematical tasks resulting from the way of their thinking, acting, and feeling. This attitude can be cultivated through problem-solving, encompassing motivation, persistence, heightened curiosity, and confidence in diverse unfamiliar contexts (Wahyuni et al., 2024).

Table 3

The Level of Attitude towards Mathematics of Public School Grade 11 Students

	Mean		SD	Description
Negative Attitude towards Mathematics				
	They are not …			
1.	showing much interest in solving problems in mathematics. *	2.63	.78	Moderate
2.	having liked mathematics because they find it difficult to understand.*	2.45	.81	Moderate
3.	finding mathematics as their favorite subject. *	2.35	.89	Moderate
4.	spending more time on mathematics than other subjects .*	2.16	.82	Low
5.	having liked mathematics subject.*	2.27	.86	Moderate
6.	getting high marks in mathematics because they do not like the subject. *	2.17	.76	Low
	Category Mean *	**2.34**	**.40**	**Moderate**
Tendency to Avoid Mathematics				
	They are …			
1.	not having liked to discuss the subject of mathematics with others.*	2.16	.76	Low
2.	losing interest in their studies because of mathematics. *	1.94	.73	Low
3.	not having liked calculations in mathematics. *	2.02	.77	Low
4.	trying to avoid people talking about mathematics. *	2.09	.78	Low
5.	finding it difficult to sit in the class during mathematics.*	2.24	.84	Moderate
	Category Mean *	**2.11**	**.44**	**Low**
Positive Attitude towards Mathematics				
1.	Mathematics is an interesting subject.	3.04	.73	High
2.	liking mathematics very much.	2.70	.79	Moderate
3.	liking mathematics more than other subjects.	2.70	.84	Moderate
4.	having used their free time to study mathematics.	2.68	.86	Moderate
5.	liking mathematics as it helps them to think systematically.	2.84	.78	High
	Category Mean	**2.79**	**.47**	**Moderate**
	Over-all Mean	**3.47**	**.15**	**Very High**

Note: * Reversed before computing the category mean and the overall mean

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Significance of the Mediating Effect of Metacognitive Thinking Skills on the Relationship of Academic Motivation and Attitude towards Mathematics of Grade 11 Students

To assess the significance of metacognitive thinking skills as mediator between academic motivation and attitude towards mathematics of public school Grade 11 students, the mediating analysis was conducted using JASP applications. In Table 4, the direct effects, indirect effects, total effects, and path coefficients. On the one hand, the direct effect of academic motivation on the attitude towards mathematics without considering the mediator, metacognitive thinking skills is 0.094 ($p > 0.05$) which is not significant. It indicates that for each unit increase in the academic motivation, attitude toward mathematics increase by 0.094 units directly. This means that academic motivation has no significant direct influence on the attitude towards mathematics but still need to consider the mediation process to see if the relationship is explained by metacognitive thinking skills.

On the other hand, the indirect effect of academic motivation on attitude towards mathematics through metacognitive thinking skills is 0.117 ($p < .05$). As such, academic motivation affects metacognitive thinking skills which then affect attitude towards mathematics. It means that part of the effect of academic motivation on attitude towards mathematics happens through metacognitive thinking skills. This suggests that metacognitive thinking skills do play a significant role in explaining how the academic motivation impacts attitude towards mathematics.

Meanwhile, the total effect represents the combined effect of the academic motivation on attitude towards mathematics, including both directly and indirectly including the mediation via metacognitive thinking skills. This means that the total effect of academic motivation on attitude towards mathematics is 0.211 units ($p < 0.05$) considering both direct and indirect pathways. Correspondingly, it is the overall influence of the independent variable, academic motivation on the dependent variable, which is significant on attitude towards mathematics which is larger than the direct effect because it includes the mediation pathway.

Moreover, the r-squared for attitude towards mathematics is 0.041 indicating that approximately 4.1 percent of the variance in attitude towards mathematics is explained by the model, which includes academic motivation and metacognitive thinking skills as predictors. It suggests a weak explanatory power because the model explains less than half of the variability in attitude towards mathematics. Accordingly, the r-squared for metacognitive thinking skills is 0.222 which means that 22.2 percent of the variance in metacognitive thinking skills is explained by the academic motivation. This shows that the academic motivation explains a good portion of the variability in metacognitive thinking skills.

Based on the mediation analysis results, full mediation occurs when the direct effect of the independent variable (IV) on the dependent variable (DV) becomes non-significant after accounting for the mediator. In this case, since the direct effect (IV → DV) is not significant ($p = 0.366$), and there is a significant indirect effect ($p = 0.016$), this suggests that metacognitive thinking skills fully mediate the relationship between academic motivation and attitude towards mathematics. Adding on, the significant indirect effect suggests that academic motivation influences attitude towards mathematics entirely through metacognitive thinking skills. The lack of a significant direct effect indicates that the media tor fully accounts for the relationship between academic motivation and attitude towards mathematics. With this, the mediation model presented in Figure 1 suggests that metacognitive thinking skills is an important pathway through which the academic motivation influences attitude towards mathematics, making this a significant and interpretable model for understanding how the academic motivation impacts attitude towards math.

Finally, the findings support the idea that cognitive, conative, and affective processes are interconnected and must be examined collectively in the context of learning and instruction as emphasized in the Theory of Cognitive-Conative-Affective Processes (Snow & Farr, 1987). This theory characterizes the impact of metacognitive processes to the attitude of theory which indicates the interplay between these three processes instead of regarding them as separate domains of inquiry. As academic motivation of students towards mathematics. More importantly, the mediating effect of metacognitive thinking skills to the relationship between academic motivation and attitude towards mathematics exemplifies the notion of the impacts the metacognitive thinking skills of the students, it indirectly influences their attitude towards mathematics. This also suggests that metacognitive thinking skills do play a significant role in explaining how the academic motivation impacts attitude towards mathematics. Therefore, students who develop motivation in learning mathematics develop effective metacognitive thinking skills which then impacts their attitude towards the subject.

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Table 4
Mediation Analysis of Metacognitive Thinking Skills on the Relationship between Academic Motivation and Attitude towards Mathematics

Independent Variable (IV)	Academic Motivation
Dependent Variable (DV)	Attitude towards Mathematics
Mediating Variable (MV)	Metacognitive Thinking Skills

	Standardized Beta (β)	Standard Error	p-value
Direct Effects (IV → DV)			
Academic Motivation on Attitude towards Mathematics	0.094	0.104	0.366
Indirect Effects (IV→ MV → DV)			
Academic Motivation→ Metacognitive Thinking Skills → Attitude towards Mathematics	0.117	0.051	.022
Total Effects (IV → MV)			
Academic Motivation → Metacognitive Thinking Skills	0.211	0.093	0.024
Path Coefficients			
Metacognitive Thinking Skills → Attitude towards Mathematics	0.166	0.070	0.018
Academic Motivation → Attitude towards Mathematics	0.094	0.104	0.366
Academic Motivation → Metacognitive Thinking Skills	0.702	0.083	<.001

	r-squared
Attitude towards Mathematics	0.041
Metacognitive Thinking Skills	0.222

CONCLUSION AND RECOMMENDATION

Based on the findings, the following conclusions were drawn:

1. The high level of academic motivation among Grade 11 students indicates that students often show pleasure in learning new concepts in mathematics, enjoy surpassing their accomplishments, believe that they are capable of learning, understand what they are learning in mathematics, and believe that learning mathematics can help them achieve good life later.
2. The high level of metacognitive thinking skills among Grade 11 students indicates that they often assure that they understand what they have learned, are aware of their own thinking, monitor their learning and progress, try other methods to arrive at a solution, reassess their thought process, consider the consequences of their decision, correct their errors, and alter their methods when necessary.
3. The very high level of attitude towards mathematics among Grade 11 students indicates that they always show interest in mathematics, get high marks because they like mathematics, discuss mathematics concepts with others, use their free time to study mathematics, and manifest positive attitude towards mathematics.
4. The weak positive correlation suggests that an increase in students' academic motivation and metacognitive thinking skills would likely increase their attitude towards mathematics.
5. Metacognitive thinking skills significantly predict attitude towards mathematics. Moreover, academic motivation and metacognitive thinking skills combined significantly influence attitudes towards mathematics.
6. Metacognitive thinking skills fully mediate the relationship between academic motivation and attitude towards mathematics. Academic motivation influences students' attitude towards mathematics through metacognitive thinking skills. Hence, academic motivation influences students' attitude towards mathematics entirely through metacognitive thinking skills.

Based on the findings and the conclusions, the following recommendations were drawn:

1. It has been found that the public school Grade 11 students have high level of academic motivation, it can be raised higher to very high level. Teachers have a big part in raising students' motivation in learning mathematics especially in making students realize the importance of mathematics in their future careers. They may make learning engaging, relevant, and meaningful for the students. They may design contextualized lessons where students can directly relate mathematics concepts to their immediate environment.
2. Since the metacognitive thinking skills of the public school Grade 11 students is high, it can still be raised

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higher to very high. Raising students' metacognitive thinking skills, specifically improving their decision making in mathematics, involves teaching them to think about their own thinking, plan their problem-solving strategies, and reflect on their learning processes.

3. The level of attitude towards mathematics among public school Grade 11 students is very high, it can still be maintained. In maintaining favorable attitude towards mathematics, teachers may create an environment where students feel confident, engaged, and see the value of math in their lives.
4. The study revealed that attitude towards mathematics is significantly related to academic motivation and metacognitive thinking skills, teachers should implement strategies that enhance both areas while fostering a positive perception of mathematics.
5. Academic motivation and metacognitive thinking skills combined significantly impact attitude towards mathematics. However, it can be observed that these factors only explains little variance in the mathematical attitude of students, hence future researchers may conduct a study including other factors related to self-determination including autonomy and competence of students.

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