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THE MEDIATING ROLE OF ATTITUDE TOWARDS MATHEMATICS IN THE RELATIONSHIP BETWEEN CLASSROOM MANAGEMENT AND MATHEMATICS ENGAGEMENT AMONG STUDENTS

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ABSTRACT

This study aimed to investigate the mediating role of attitude towards mathematics in the relationship between classroom management and mathematics engagement among students. A quantitative research design utilizing descriptive and correlational approach was employed, with a total of 308 respondents surveyed from a group of grade 11 students in a private senior high school institution in Tagum City Division, Davao del Norte, Philippines, for the S.Y. 2024-2025. Data were obtained using three adapted questionnaires that were validated and treated using specific statistical treatments such as the mean, Pearson's r, and mediation analysis. The findings revealed that the classroom management practiced by the mathematics teachers was applied on all occasions. Also, this study found that the mathematics engagement of the students was manifested and students' positive attitude towards mathematics was demonstrated most of the time. Moreover, the study revealed a significant relationship between classroom management and mathematics engagement, with $r = 0.502$ and p-value < 0.05. This study also found that classroom management had a significant relationship with students' attitudes toward mathematics, with $r=0.401$ and p-value<0.05. In addition, attitude towards mathematics and mathematics engagement was also found to have a significant relationship having $r = 0.819$ and $p < 0.05$. Further, it was also presented in this study that students' attitudes toward mathematics significantly mediate the relationship between classroom management and mathematics engagement. The results suggest that enhancing students' attitudes toward mathematics by incorporating it with the math teachers' classroom management could lead to an increase in mathematical engagement among the students.

KEYWORDS: *Mathematics, Engagement, Classroom Management, Attitude Towards Mathematics, Grade 11 Students, Descriptive And Correlational, Mediation Analysis, Tagum City, Davao Del Norte Philippines*

INTRODUCTION

Learner's enthusiasm in participating in math classes is all expressed through their engagement in mathematics. Their engagement with mathematics is critical to their acquisition of mathematical knowledge and skills (Sen, 2022). However, students' disposition towards math subjects is generally negative, and this shows up as students' low engagement in math (Gil-Doménech & Berbegal-Mirabent, 2019). Mathematics engagement is also one of the problems encountered by teachers (Sasidharan & Kareem, 2023). For the past years, there have been a lot of studies on the engagement of students that encourage students to participate actively in their mathematical education due to the growing number of students' disengagement from mathematics, which can impede students' mathematical performance and achievement (Cevikbas & Kaiser, 2022). Also, studies have found that in other countries, because of the students' lack of mathematics engagement, they opt to avoid taking mathematics courses (Attard & Holmes, 2020). Thus, when the student's mathematics engagement depreciates, it will also decrease their learning in mathematics (Pineda et al., 2023).

A study conducted in Indonesia found that students were left with poor mathematics engagement. Students tend to be passive in the sense that most of the mathematics learning activities were teacher-centered (Mentari & Syarifuddin, 2020). Also, in Malaysia, students' mathematics engagement remains at a moderate level because it is given limited attention, as teacher-centered instruction is still a common practice. This indicates that students' ability to apply mathematical concepts to different circumstances may be limited by this dependence, which could impede their learning progress (Maamin et al., 2021). Moreover, in China, mathematics engagement of the students had a mean closer to 3 on its cognitive engagement, which implies that the students who participated in the study did not

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strongly exhibit cognitive engagement in learning mathematics. Therefore, students have poor focus in their math classes. With that, they concluded that it is necessary to investigate a deeper understanding of the students' mathematics engagement (Zhang et al., 2023).

In the Philippines, particularly in Calamba City, a study conducted on 60 respondents showed a moderate mean of 4.12 on a 7-point Likert Scale regarding their disengagement in mathematics. Thus, the students' mathematics engagement exhibited a tendency to withdraw from classroom activities and unhappiness in school (Querido et al., 2023). Also, in Balamban, Cebu, a national public high school observes that mathematics lessons tend to be less engaging for students when they are unable to follow along with the teacher's explanations, especially when the teacher is covering a topic that requires a certain level of prior knowledge (Peteros et al., 2022). Furthermore, it is also observed in some areas of Davao del Norte, where teachers encounter problems with students' mathematics engagement. In a study at a particular institution in Santo Tomas Davao del Norte, STE (Science, Technology, and Engineering) students showed a minimum level of mathematics engagement with a mean of 3.76 on a 6-point Likert scale, which implies that students engage more in mathematics when they appreciate the value of mathematics even more (Macaso & Dagohoy, 2022).

In a particular private senior high school in Tagum City, a math teacher who handled different strands for Grade 11 observed that only 7 to 10 students out of 40 per section were consistently participating during math classes. Students were also observed to disengage when there were no interactive activities conducted and when they received negative feedback, such as having a low score or grades. In addition, a study conducted in Tagum City stated that 23% of the students in the S.Y. 2021-2022 were reported by a certain guidance office for having a problem with their math subject, which resulted in students' low engagement in mathematics because they became doubtful about their abilities in math (Rentuaya et al., 2024).

The problems mentioned above have made it very evident that there are issues related to the mathematics engagement of the students. Even though there are existing literatures on mathematics engagement, few studies have been conducted in the local setting. Some of these also served as the independent variable or used different educational levels for their respondents (Corpuz & Casocot, 2022; Flores et al., 2021), and much of them were done in a global context (Mentari & Syarifuddin, 2020; Maamin et al., 2021; & Zhang et al., 2023). In this study, the researcher wants to venture into mathematics engagement as the dependent variable, particularly with senior high school students.

Furthermore, the researcher believes that the urgency of conducting this study offers fresh perspectives on what causes students to engage or not engage in math classes. Since this study is being conducted in the Philippines, particularly in Tagum City, Davao del Norte, it provides an additional discussion about mathematics engagement in the local setting. This study also provides a basis for how to address the problem with mathematics engagement since few studies have been found in the local setting, particularly at the secondary level. Moreover, the researcher is hopeful that this study will help the intended beneficiaries gain an additional basis to possibly reinforce the established action plans in improving the mathematics engagement of the students. Also, it aims to fill the gaps in understanding the problem, particularly emphasizing its connection with classroom management and students' attitude towards mathematics.

The researcher aims to disseminate the findings of this study through national or international research forums that deal with mathematical research. Also, a copy of this study will be submitted to an online publication to be posted in an academic journal to reach a wider audience and provide future researchers, particularly in the local setting, with additional literature and to the other entities that will possibly benefit from the findings of this study. Consequently, the participating schools in this study will also be given a hardcopy so it can be accessed in their school libraries.

OBJECTIVES

The main objective of this research is to determine whether attitude towards mathematics explains the relationship between classroom management and mathematics engagement among the grade 11 students in Tagum City Division, S.Y. 2024-2025. Particularly, it answers the questions that follow:

1. What is the extent of classroom management in terms of learning environment, students' emotional aspects, planning, time management, and discipline?
2. What is the level of mathematics engagement in terms of behavioral engagement, affective engagement, and cognitive engagement?
3. What is the level of attitudes towards mathematics in terms of self-confidence, value, enjoyment, and motivation?
4. Is there a significant relationship between (a) classroom management and mathematics engagement, (b) classroom management and attitude towards mathematics, and (c) attitude towards mathematics and mathematics engagement?
5. Does attitude towards mathematics significantly mediate the relationship between classroom management and mathematics engagement?

METHODOLOGY

Research Design

A quantitative approach utilizing descriptive and correlational design was employed in this research study. With the use of the quantitative research approach and analyzing the relationship between variables, objective theories can be tested. Since these variables can typically be measured with tools, quantitative data may be analyzed using statistical methods (Creswell &

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Creswell, 2018). Also, in a quantitative research approach, the problem is quantified by producing numerical data, and the phenomenon is explained through collecting data that are numerical or data that can be statistically analyzed (Amorado et al., 2017). In this study, it is appropriate to use a quantitative research approach to gather numerical data for analysis. Survey questionnaires will be utilized in determining the extent and relationship of the variables: classroom management, mathematics engagement, and attitude towards mathematics. With survey instruments and computational tools, data will be acquired through the conducting of surveys. Also, in this study, a descriptive design will be employed to determine the extent or level of the variables, and a correlational design to assess the relationship between the variables.

The descriptive design that will be employed in this study will aim to provide a description of the data for a better understanding of the sample's characteristics (Thomas et al., 2023). Without altering any of the variables, the researcher will only provide a description of the sample and/or variables. Furthermore, quantitative data will be collected to enable statistical analysis of a population sample (Siedlecki, 2020). The descriptive design will be employed in this study because it will illustrate the extent of specific behaviors of the students, particularly assessing the extent of classroom management, mathematics engagement, and attitude towards mathematics among Grade 11 students as they appear in a particular context or setting. To obtain a thorough understanding of the sample, questionnaires will be utilized to measure the indicators of each variable.

Moreover, the relationship between two or more variables can be studied using a correlational design, which will also be employed in this study. It will enable researchers to determine whether a relationship between variables exists and, if so, how strong it is and in what direction (Hassan, 2023). This shows if a rise or fall in one measure is correlated with a rise or fall in the other. However, a correlational study indicates a relationship between variables, but it cannot establish a causal relationship between the two variables (Lillykutty & Samson, 2018). In this study, the correlational design was also adapted because it determined the significance of the relationship between the variables: the relationship between classroom management and mathematics engagement, classroom management and attitude towards mathematics, and attitude towards mathematics and mathematics engagement among Grade 11 students.

Research Respondents

The respondents of this study were grade 11 students from four private senior high schools in Tagum City Division, Davao del Norte. From a population of 1,527 students enrolled in the academic year 2024-2025, the researcher came up with 308 students as the total number of respondents using Raosoft's formula with a confidence level of 95% and a margin of error of 5%. The researcher chose 8 samples from School 1 out of 40 students; 84 samples from School 2 out of 418 students; 157 samples from School 3 out of 777 students; and 59 samples from School 4 out of 292 students.

In this study, grade 11 students from each school were selected using a stratified random sampling technique. Randomization using Excel was used to determine the potential respondents of the study. Since the researcher needed to randomly select the respondents from the four private senior high schools in Tagum City Division, stratified random sampling was the most appropriate technique for this study. According to Parsons (2017), it is a technique of probability sampling where it is utilized in a sample survey where the respondents of the targeted population are split into different strata or groups, and for each stratum, they are similar to one another in terms of their key important characteristics that are being considered in the survey.

Research Instrument

This study utilizes three questionnaires as instruments that were adapted from previous studies and were carefully chosen following the objectives of this research.

The research instruments were presented to the experts for validation and underwent pilot testing with a sample of students from one of Tagum City Division's senior high schools who were also grade 11 students. Consequently, the reliability of the three adapted research questionnaires was tested by determining their Cronbach's Alpha value. Classroom Management in Mathematics Questionnaire (CMMQ). The instrument for classroom management was adapted from the Classroom Management in Mathematics Questionnaire (CMMQ) of Tacadena (2021). It is a 25-item questionnaire with the following dimensions: students' emotional aspect (5 items), learning environment (5 items), time management (5 items), discipline (5 items), and planning (5 items). The Cronbach's Alpha of the total scale was 0.923, which implies that it has a high internal consistency; thus, it has excellent psychometric validity and reliability measures. A 5-point Likert scale was used with the following weights: 5 - Always, 4 - Oftentimes, 3 - Sometimes, 2 - Seldom, and 1 - Never.

The following parameters limits were utilized to determine the extent of classroom management among the grade 11 students.

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Range of Means	Description	Interpretation
4.20-5.00	Very Highly Extensive	This means that the classroom management of teachers in mathematics is practiced on all occasions.
3.40-4.19	Highly Extensive	This means that the classroom management of teachers in mathematics is practiced on most occasions.
2.60-3.39	Moderately Extensive	This means that the classroom management of teachers in mathematics is sometimes practiced.
1.80-2.59	Least Extensive	This means that the classroom management of teachers in mathematics is seldom practiced.
1.00-1.79	Very Least Extensive	This means that the classroom management of teachers in mathematics is least practiced.

Learning Engagement in Mathematics Survey Questionnaire (LEMSQ)

The instrument for mathematics engagement was adapted from the Learning Engagement in Mathematics Survey Questionnaire (LEMSQ) of Pineda et al. (2023), which was also adapted from the Students' Engagement in Mathematics Survey Questionnaire (SEMSQ) of Flores et al. (2021). This is a 30-item questionnaire with the following dimensions: affective engagement (10 items), behavioral engagement (10 items), and cognitive engagement (10 items). The Cronbach's Alpha of the total scale was 0.948, indicating that it has a high internal consistency, and that every descriptive survey for the mathematics engagement dimension is reliable. A 5-point Likert scale was utilized, with the following weights: 5 – Strongly Agree, 4 – Agree, 3 – Moderately Agree, 2 – Disagree, and 1 – Strongly Disagree.

The following parameters were utilized to determine the level of mathematics engagement among the grade 11 students.

Range of Means	Description	Interpretation
4.20-5.00	Very High	This means that the students' mathematics engagement is greatly manifested.
3.40-4.19	High	This means that the students' mathematics engagement is manifested.
2.60-3.39	Moderate	This means that the students' mathematics engagement is somewhat manifested.
1.80-2.59	Low	This means that the students' mathematics engagement is less manifested.
1.00-1.79	Very Low	This means that the students' mathematics engagement is least manifested.

Attitudes Towards Mathematics (ATM)

The instrument for attitudes toward mathematics was adapted from the Attitudes Towards Mathematics (ATM) Questionnaire of Emata (2023). This is a 32-item questionnaire with the following dimensions: value (7 items), self-confidence (12 items), motivation (4 items), and enjoyment (9 items). The Cronbach's Alpha of the total scale of this instrument is 0.971, which implies that a very high reliability coefficient has been obtained. Thus, it has excellent psychometric validity and reliability measures. A 5-point Likert scale was used with the following weights: 5 - Very High, 4 - High, 3 - Moderate, 2 - Low, and 1 - Very Low.

To determine the extent of attitudes toward mathematics among the grade 11 students, the parameter limits below will be used.

Range of Means	Description	Interpretation
4.20-5.00	Very High	This means that the students' attitude towards mathematics is demonstrated at all times.
3.40-4.19	High	This means that the students' attitude towards mathematics is demonstrated most of the time.
2.60-3.39	Moderate	This means that the students' attitude towards mathematics is sometimes demonstrated.
1.80-2.59	Low	This means that the students' attitude towards mathematics is seldom demonstrated.
1.00-1.79	Very Low	This means that the students' attitude towards mathematics is rarely demonstrated.

Statistical Treatment of Data

The following listed statistical tools were the appropriate tools to compute and interpret the data of this study

Mean. This refers to the quantity that serves as the sum of all the numbers in the set. It is a statistical tool that is used in assessing the classroom management, mathematics engagement, and attitude towards mathematics of the students. Also, it is used to answer questions 1, 2, and 3 of this research.

Standard Deviation. It is a descriptive statistic that measures the dispersion of the datasets from its mean. It also serves as a tool that quantifies how the data are close to or scattered from the mean. This is also used to answer questions 1, 2, and 3 of this research.

Pearson-r Correlation. It is used as a metric of correlation that is employed to confirm the significance of the relationship between classroom management and mathematics engagement, classroom management and attitude towards mathematics, and attitude towards mathematics and mathematics engagement. It is employed to answer questions 4.1, 4.2, and 4.3 of this research. It also assumes the normality, homogeneity, and absence of multicollinearity of the data.

Mediation Analysis in Sobel Test. Through a mediating variable, this is used to assess the mediation of the independent variable and a dependent variable. It is also employed to determine the mediating role of attitude towards mathematics in the relationship between classroom management and mathematics engagement. In addition, it is used to answer research question number 5.

RESULTS

1. Among the five indicators in determining the extent of classroom management, the students' emotional aspect had the highest mean of 4.42, indicating that the classroom management of the teachers in mathematics with regards to students' emotional aspect is practiced on all occasions. The standard deviation of 0.71 signifies that the responses of the students are clustering around the mean. This is followed by planning, with a mean of 4.29 and a standard deviation of 0.74, discipline, with a mean of 4.28 and a standard deviation of 0.75. The students' emotional aspect, planning, and discipline were classified as "very highly extensive." Additionally, time management has a mean of 4.13, with a standard deviation of 0.73, and the learning

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environment scored the lowest mean of 4.09 among all the indicators. This indicates that the classroom management of the teachers in mathematics, in terms of the learning environment, is practiced on most occasions. Its standard deviation is 0.74, which signifies that the responses of the respondents are near the mean. The learning environment is also classified as "highly extensive," the same as time management, even though it has the lowest mean. The overall mean of classroom management is 4.24, which is classified as "very highly extensive." The overall standard deviation of this variable is 0.61, indicating that the variation of the responses is closer to the mean. This suggests that most of the students agree that the teachers in mathematics practice classroom management on all occasions.

2. Among the three indicators in determining the level of mathematics engagement, behavioral engagement had the highest mean of 3.95. This indicates that the students' behavioral engagement is manifested. It has a standard deviation of 0.74, which implies that the responses of the students are closer to the mean. This is followed by cognitive engagement, which has a mean of 3.69 and a standard deviation of 0.83. Conversely, the indicator that scored the lowest is affective engagement, with a mean of 3.54. This indicates that the students' affective engagement is manifested. Its standard deviation of 0.90 signifies that although most of the students agree, there are still some variations in their responses. Moreover, the overall mean of mathematics engagement is 3.72, which indicates that the students' mathematics engagement is manifested. Also, the overall standard deviation of this variable is 0.72, meaning that the students' responses are relatively similar, indicating that their mathematics engagement is manifested. Additionally, since all the indicators are classified as "high," the overall descriptive equivalent of mathematics engagement is also "high."
3. Among the four indicators to determine the level of attitude towards mathematics, value scored the highest mean of 3.84. This is classified as "high," which indicates that the students' attitude towards mathematics, with value, is demonstrated most of the time. The standard deviation of 0.90 signifies that most of the students agree**,** but some responses still vary. This is followed by the indicator motivation, with a mean of 3.39, and enjoyment**,** with a mean of 3.36. Their standard deviations are 1.04 and 1.02, respectively**,** and both have a descriptive equivalent of "moderate." The indicator that got the lowest mean of 3.18 is self-confidence**,** which is also classified as "moderate." This implies that the students' attitude towards mathematics, with regard to self-confidence, is sometimes demonstrated. Its standard deviation is 0.94, which means that the responses of the students are clustering around the mean and are somewhat similar. Moreover, the overall mean for attitude towards mathematics is 3.44, which is classified as "high." This indicates that the students' attitude towards mathematics is demonstrated most of the time. The overall standard deviation of this variable is 0.86, which suggests that the responses of the students are clustered around the mean and therefore the students have a similar perception that their attitude towards mathematics is demonstrated most of the time.
4. The relationship between classroom management and mathematics engagement showed a moderate relationship, with a correlation coefficient of 0.502 and $p<0.05$, which indicates that the relationship is significant. Also, the relationship between classroom management and attitude towards mathematics is moderate, with a correlation coefficient of 0.401 and $p<0.05$, which implies that the relationship is significant. In addition, the relationship between attitude towards mathematics and mathematics engagement is very strong, with a correlation coefficient of 0.819 and $p<0.05$, which suggests that the relationship is significant.
5. The Sobel z-value is 7.26, and $p < 0.000001$, which indicates that the relationship between classroom management and mathematics engagement is significantly mediated by attitude towards mathematics.

RECOMMENDATIONS

Based on the findings of this study, students are encouraged to develop positive learning habits, particularly with mathematics, to enhance their self-confidence in solving mathematical problems without difficulty. To help students improve in such, math teachers are encouraged to establish clear routines so that the students feel prepared and confident during math classes. It is also suggested that math teachers make use of visual presentations to maximize the utilization of time and maintain the orderliness of the classroom to avoid disruptions from constantly erasing the board after use. Hence, students will be given ample time to ask questions for clarifications on the things that were difficult for them to understand. School administrators are also advised to organize additional training programs that will give the teachers an opportunity to improve their teaching and instructional strategies that will help enhance students' positive attitude towards mathematics. Parents are also encouraged to actively support their children by allowing them to participate in any mathematical activities in the school to foster confidence in the subject. Moreover, future researchers can utilize the findings of this study and look further into other factors that may influence the mathematics engagement of the students, their engagement with mathematics, and the classroom management.

CONCLUSION

The extent of the classroom management practiced by the teachers in mathematics is very highly extensive. The level of the students' mathematics engagement is high. The level of the students' attitude towards mathematics is also high. There is a significant relationship between classroom management and mathematics engagement, classroom management and attitude towards mathematics, and attitude towards mathematics and mathematics engagement. Lastly, attitude towards mathematics

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significantly mediates the relationship between classroom management and mathematics engagement.

TABLES

Table 1. The Extent of Classroom Management

Indicators	SD	Mean	Descriptive Equivalent
Learning Environment	0.74	4.09	Highly Extensive
Students Emotional Aspect	0.71	4.42	Very Highly Extensive
Planning	0.74	4.29	Very Highly Extensive
Time Management	0.73	4.13	Highly Extensive
Discipline	0.75	4.28	Very Highly Extensive
Category	**0.61**	**4.24**	**Very Highly Extensive**

Table 2. The Level of Mathematics Engagement

Indicators	SD	Mean	Descriptive Equivalent
Affective Engagement	0.90	3.54	High
Behavioral Engagement	0.74	3.95	High
Cognitive Engagement	0.78	3.69	High
Category	**0.72**	**3.72**	**High**

Table 3. The Level of Attitude Towards Mathematics

Indicators	SD	Mean	Descriptive Equivalent
Self-Confidence	0.94	3.18	Moderate
Value	0.90	3.84	High
Enjoyment	1.02	3.36	Moderate
Motivation	1.04	3.39	Moderate
Category	**0.86**	**3.44**	**High**

Table 4. Significance of the Relationship between the variables

Variables Correlated	r	p-value	Decision on H_o	Remarks on Relationship
Classroom Management & Mathematics Engagement	0.502	0.000	Rejected	Significant
Classroom Management & Attitude Towards Mathematics	0.401	0.000	Rejected	Significant
Attitude Towards Mathematics & Mathematics Engagement	0.819	0.000	Rejected	Significant

Table 5. The Mediation Analysis of Attitude Towards Mathematics on Classroom Management and Mathematics Engagement

Significance of Mediation			Significant
Sobel z-value		7.256617	$p = < 0.000001$
95% Symmetrical Confidence Interval			
	Lower	.25506	
	Upper	.44515	
Unstandardized Indirect effect			
	a*b	.35060	
	se	.04829	
Effect size Measures			
	Standardized Coefficients		R^2 Measures (variance)
	Total:	.822	.293
	Direct:	.243	.001
	Indirect:	.293	.290
	Indirect to Total Ratio:	.997	.998

FIGURES

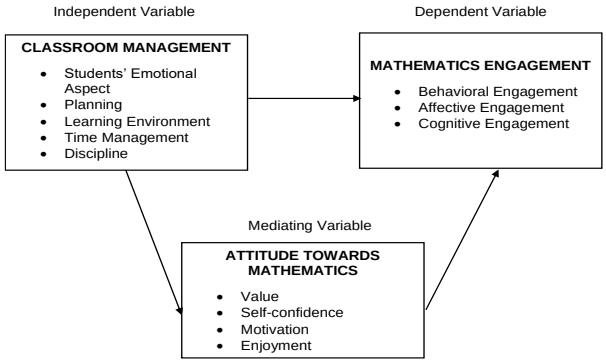


Figure 1. Conceptual Paradigm of the Study



Source: Google Map

Figure 2. Map of the Philippine Highlighting Tagum City, Davao del Norte

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