

# STUDENT Mathematics Motivation and Learning Environment as Predictors of Student Engagement in Math among Private Catholic Senior High School Students in Davao CITY

Claribel O. Fernandez<sup>1</sup>, Mona L. Laya, PhD<sup>2</sup>

<sup>1</sup>Teacher, University of the Immaculate Conception  
cfernandez\_1600033@uic.edu.ph

<sup>2</sup>University of the Immaculate Conception, Davao City  
mlaya@uic.edu.ph

## ABSTRACT

This study investigated the influence of mathematics motivation and the learning environment on student engagement in mathematics among senior high school students in private Catholic schools in Davao City. Recognizing the importance of engagement to academic success, the study aimed to determine whether students' levels of motivation and the quality of their learning environment are significantly related to and influence their engagement in math classes. A quantitative research design using a descriptive-correlational approach was employed. The respondents were selected through cluster sampling and comprised senior high school students currently enrolled in selected private Catholic institutions. Data were gathered using validated and adapted survey questionnaires designed to measure mathematics motivation, learning environment, and student engagement. The statistical tools used for data analysis included the mean, standard deviation, Pearson product-moment correlation coefficient, and multiple regression. Findings revealed that the respondents often demonstrated high levels of mathematics motivation, a positive learning environment, and student engagement in mathematics. The correlation analysis indicated a significant relationship between mathematics motivation and student engagement, as well as between the learning environment and student engagement. Furthermore, the results of the multiple regression analysis showed that both mathematics motivation and the learning environment significantly influence student engagement in math. These findings suggest that students are more likely to engage in mathematics learning when they are motivated and experience a supportive, organized classroom environment.

**KEYWORDS:** *Student mathematics motivation, learning environment, student engagement, descriptive correlation, multiple regression.*

## INTRODUCTION

Student engagement in mathematics has emerged as a significant concern in education, particularly given its impact on students' problem-solving abilities, academic success, and sustained interest in the subject. Engagement, which includes emotional, social, and cognitive participation in learning, plays a crucial role in developing analytical thinking and academic growth in mathematics (Torrejos, 2024; Amrai & Motlagh, 2021). However, studies increasingly show that students are becoming disengaged, with recent international data indicating that about one in four students shows low engagement and low mathematics literacy (OECD, 2022). Similar findings in the United States, United Kingdom, and South Africa reflect a global pattern of declining interest in math, often due to perceived irrelevance, low motivation, and lack of supportive environments (Bekker et al., 2024; Thomson & Nye, 2021; Gallup, 2016).

In the Philippines, the situation is likewise concerning. The Department of Education (2023) reported that national mathematics scores remain below 50 percent, suggesting persistent issues with student engagement. Other local studies highlight how negative peer environments, lack of teacher support, and traditional instructional strategies contribute to disengagement (Reyes, 2019; Gutierrez & Doronio, 2024; Carandang et al., 2023). Regionally, in Davao City and Mindanao, similar patterns of low arithmetic performance and disinterest in math have been reported, particularly when content is not contextualized to students' lives (Salva et al., 2017; Dayaganon et al., 2023).

Among the major factors influencing student engagement are mathematics motivation and the learning environment. Motivation, both intrinsic and extrinsic, has been shown to influence persistence and effort in mathematical tasks (Rodiana & Laelasari, 2024). Students who value math or are driven by personal goals or external rewards tend to participate more actively in class. At the same time, a supportive learning environment characterized by teacher support, peer cooperation, fairness, and emotional safety is positively correlated with greater student engagement (Jin et al., 2023; Madarmuk et al., 2025).

While several studies have separately examined motivation and the learning environment, few have integrated these two variables to determine their combined influence on engagement. More importantly, there is a scarcity of research focusing specifically on senior high school students in private Catholic

schools in the Philippines. Most previous studies have centered on elementary or general populations and relied heavily on qualitative designs. This research, therefore, seeks to fill that gap by using a quantitative correlational approach to examine the influence of students' mathematics motivation and learning environment on student engagement in math among senior high school students in private Catholic institutions in Davao City.

### Research Questions

This study determined the significance of the influence of student's mathematics motivation and learning environment as predictors of student engagement in math among Catholic senior high school students in Davao City. Specifically, it sought answers to the following questions:

1. What is the level of student's mathematics motivation in terms of:
  - 1.1 intrinsic motivation;
  - 1.2 extrinsic motivation; and
  - 1.3 perception about mathematics?
2. What is the status of learning environment in terms of:
  - 2.1 student closeness;
  - 2.2 teacher support;
  - 2.3 involvement;
  - 2.4 cooperation; and
  - 2.5 fairness?
3. What is the level of student engagement in math in terms of:
  - 3.1 emotional engagement;
  - 3.2 social engagement; and
  - 3.3 cognitive engagement?
4. Is there a significant relationship between:
  - 4.1 students' mathematics motivation and student engagement, and
  - 4.2 learning environment and student engagement?
5. Do students' mathematics motivation and learning environment significantly influence student engagement?

### METHODS

**Research Design.** This study employed a quantitative, descriptive-correlational design to examine the relationships among students' mathematics motivation, learning environment, and student engagement in math. This design was appropriate for exploring how variables relate in a natural setting without manipulation. Quantitative methods allowed for the collection of numerical data and statistical analysis to identify patterns and measure the

strength of associations among variables (Creswell, 2014; Seeram, 2019). The design provided a reliable basis for understanding how key factors influence student engagement in mathematics. While this quantitative, descriptive-correlational design gives helpful insights into the relationships among variables, it cannot establish causal relationships among mathematics motivation, the learning environment, and student engagement.

**Research Locale.** This study was conducted in three private Catholic schools in Davao City, Davao del Sur, referred to as School A, School B, and School C to maintain institutional anonymity. These schools offer complete basic education programs and uphold Catholic values. Davao City was selected for its diverse educational landscape and the unique challenges faced by students in private institutions.

**Research Instruments.** This study used an adapted survey questionnaire comprising three parts: the Student Mathematics Motivation Scale, the Learning Environment Scale, and the Student Engagement in Math Scale. The instrument was validated by three experts, and reliability was tested through a pilot survey with 35 students.

The Student Mathematics Motivation Scale, adapted from Nurkarim et al. (2023), comprises 20 items across intrinsic, extrinsic, and perception-related motivation, rated on a 5-point Likert scale. It demonstrated high internal consistency (Cronbach's  $\alpha = 0.817$ ).

The Learning Environment Scale was adapted from the Indonesian version of "What is Happening in this Class" (Rahayu et al., 2021) and comprises 42 items measuring teacher support, involvement, cooperation, and fairness. It also used a 5-point Likert scale and showed excellent reliability (Cronbach's  $\alpha = 0.96$ ).

The Student Engagement in Math Scale, modified from Fredricks et al. (2004), included 15 items assessing emotional, social, and cognitive engagement. It also used a 5-point Likert scale and had a Cronbach's alpha of 0.90, indicating strong internal reliability.

Each scale used interpretive ranges to describe levels of mathematics motivation, the status of the learning environment, and levels of student engagement in math.

**Data Gathering Procedure.** The researcher secured permission from the graduate school dean and ethical clearance from the UIC Research Ethics Committee. The researcher also obtained approval from the school principals of the three participating private Catholic senior high schools. Informed consent forms were distributed to parents or guardians of student participants, and only those who signed the forms were included.

The researcher explained the study and consent form to students before administering the survey in designated classrooms to ensure focus and comfort. The questionnaire was completed in 30-45 minutes under the supervision of the researcher. Participation was voluntary, and students were free to withdraw at any time without consequence.

The researcher, not being a direct instructor of the participants, maintained a neutral role during data collection to minimize potential researcher bias and influence on student responses.

In compliance with the Data Privacy Act of 2012, all data were anonymized and stored in a password-protected file for five years before permanent deletion. Only relevant data were collected and used for research purposes.

**Statistical Tools.** Descriptive statistics, including mean and standard deviation, were used to determine the levels and variability of students' mathematics motivation, learning environment, and engagement in math. Pearson product-moment correlation was applied to assess the relationships among the variables. Multiple linear regression analysis was employed to identify how mathematics motivation and the learning environment predict student engagement in math.

## **Ethical Statement**

This study adhered to the ethical principles outlined in the Belmont Report (1979) and complied with the Data Privacy Act of 2012. Ethical clearance was obtained from the UIC Research Ethics Committee, and approval was secured from participating school administrators. Informed consent was obtained from the parents or guardians, and student participation was voluntary, with the right to withdraw at any time without consequence.

The study involved Grade 11 students, a vulnerable group, and ensured their protection through informed assent, confidentiality, and psychological

safety. Data collection posed minimal risk and was conducted in familiar school settings under supervision. Participants were assured of anonymity, and no identifying information was collected. All data was stored securely in a password-protected file and will be destroyed after five years.

The study promoted social value by aligning with SDG 4: Quality Education and aimed to inform school-based interventions to enhance mathematics engagement. The researcher ensured fairness in participant selection, maintained transparency throughout the research process, and upheld research integrity under qualified guidance and adequate institutional support.

## RESULTS

This section presents the findings in response to the study's research questions. Descriptive statistics, Pearson correlation, and multiple linear regression were computed using IBM SPSS Statistics 26.0 to analyze the levels and relationships among the variables.

The results are organized into five tables that present the study's key variables. Table 1 shows the level of student mathematics motivation, followed by Table 2 on the learning environment and Table 3 on the student engagement in math. Table 4 presents the significance of the relationships among motivation, the learning environment, and engagement, while Table 5 shows the predictive influence of student math motivation and the learning environment on math engagement. These tables provide an overview of students' experiences and perceptions, offering a basis for interpreting how internal and external factors impact their engagement in mathematics learning.

Table 1 presents the level of a student's mathematics motivation. The overall mean was 3.61, interpreted as high, with a standard deviation of 0.55, indicating consistent responses among students. This suggests that mathematical motivation is often demonstrated across the sample.

Intrinsic motivation had a category mean of 3.40, indicating a high level of intrinsic motivation. The highest-rated item was "achieving good results in mathematics is considered the most satisfying experience for many students," while the lowest-rated item was "not studying mathematics material before it is given by the teacher at school is a common practice among students," which is a reverse-coded item.

Extrinsic motivation had a category mean of 3.77, indicating a high level of extrinsic motivation. The highest-rated item was "Learning mathematics to enable teaching friends or others who are keen to learn is a motivation expressed by some students," while the lowest-rated item was "Thinking that applying what is learned in mathematics to other subjects is not possible is a perception held by some students," a reverse-coded item.

Perceptions of mathematics had a category mean of 3.66, indicating "high." The highest-rated item was "considering the study of mathematics important for developing the mind is a belief shared by many students," while the lowest-rated item was "feeling unsure about understanding the difficult material explained by the teacher is experienced by some students," a reverse-coded item.

**Table 1**  
*Level of Students’ Mathematics Motivation*

|                                                                                                                                                     | Mean        | SD          | Description |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|-------------|
| <b>Intrinsic Motivation</b>                                                                                                                         |             |             |             |
| 1. liking mathematics for its challenges and opportunities to learn new things is a common sentiment among students.                                | 3.79        | 0.95        | High        |
| 2. not studying mathematics out of one’s own free will is observed among some students*                                                             | 2.76        | 0.92        | Moderate    |
| 3. finding satisfaction in trying to understand mathematics content as accurately as possible is a common experience among students.                | 4.29        | 0.80        | Very High   |
| 4. not studying mathematics material before it is given by the teacher at school is a common practice among students*                               | 2.56        | 1.05        | Low         |
| 5. taking additional mathematics lessons despite the lack of guarantee for high achievement is a decision some students are willing to make.        | 3.28        | 1.04        | Moderate    |
| 6. using free time to revisit and work on previously studied mathematics questions is a practice observed among some students.                      | 2.92        | 1.13        | Moderate    |
| 7. not starting to work on mathematics questions unless prompted by the teacher is a behavior observed among some students*                         | 2.85        | 1.07        | Moderate    |
| 8. finding mathematics learning so boring that students prefer drawing, doodling, or daydreaming during class is a behavior observed in some cases* | 3.61        | 1.18        | High        |
| 9. achieving good results in mathematics is considered the most satisfying experience for many students.                                            | 4.51        | 0.84        | Very High   |
| <b>Category Mean</b>                                                                                                                                | <b>3.40</b> | <b>0.50</b> | <b>High</b> |

**Extrinsic Motivation**

|                              |                                                                                                                                          |      |      |           |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|------|------|-----------|
| 1.                           | learning mathematics to enable teaching friends or others who want to learn is a motivation expressed by some students.                  | 4.19 | 0.92 | High      |
| 2.                           | achieving good results in mathematics as a way of demonstrating abilities to family, friends, and others is important for many students. | 4.02 | 1.01 | High      |
| 3.                           | being enthusiastic about studying mathematics due to receiving gifts from parents and teachers is observed among some students           | 3.61 | 1.14 | High      |
| 4.                           | thinking that applying what is learned in mathematics to other subjects is not possible is a perception held by some students.*          | 2.96 | 1.08 | Moderate  |
| 5.                           | studying mathematics in class without feeling obligated to do so is an experience reported by some students*                             | 4.10 | 0.98 | High      |
| Category Mean                |                                                                                                                                          | 3.77 | 0.56 | High      |
| Perception about Mathematics |                                                                                                                                          |      |      |           |
| 1.                           | not feeling interested in the materials for mathematics learning is experienced by some students*                                        | 3.80 | 0.94 | High      |
| 2.                           | believing that learning every material in mathematics is useful is a common perception among students                                    | 4.09 | 0.83 | High      |
| 3.                           | considering the study of mathematics important for developing the mind is a belief shared by many students.                              | 4.26 | 0.81 | Very High |
| 4.                           | being confident in understanding both difficult and basic mathematics material is reported by some students.                             | 3.45 | 1.08 | High      |
| 5.                           | feeling unsure about understanding the difficult material explained by the teacher is experienced by some students*                      | 2.70 | 1.07 | Moderate  |
| 6.                           | lacking enthusiasm for studying mathematics due to its perceived irrelevance to personal dreams is noted among some students*            | 3.68 | 1.02 | High      |
| Category Mean                |                                                                                                                                          | 3.66 | 0.59 | High      |
| Over-all Mean                |                                                                                                                                          | 3.61 | 0.55 | High      |

Table 2 presents the status of the learning environment. The overall mean was 4.02, with a standard deviation of 0.67, indicating a consistently high level of learning environment as observed by students. This reflects frequent experiences of a supportive, engaging, and equitable classroom setting. Student closeness had a category mean of 4.01, indicating strong peer relationships and a sense of belonging in class. Teacher Support had a category mean of 3.75, interpreted as high, reflecting positive teacher-student relationships, though with some variability in perceived emotional support. Involvement had a category mean of 3.81, indicating students' active participation in classroom activities and discussions. Cooperation, with a category mean of 4.28, indicated a very high level of collaboration and highlighted a collaborative classroom culture. Fairness



had a category mean of 4.27, indicating a very high level of perceived equal treatment and recognition in class and suggesting a shared sense of equal treatment and recognition among students.

**Table 2**  
*Level of Learning Environment*

|                                                                                                   | Mean        | SD          | Description |
|---------------------------------------------------------------------------------------------------|-------------|-------------|-------------|
| <b>Student Closeness</b>                                                                          |             |             |             |
| 1. liking being friends with classmates is common among students.                                 | 4.37        | 0.85        | Very High   |
| 2. knowing the students in the class helps in feeling comfortable.                                | 4.59        | 0.62        | Very High   |
| 3. being fond of spending time with classmates is a sentiment shared by many.                     | 3.91        | 0.93        | High        |
| 4. valuing friendships with classmates is considered important by students.                       | 3.97        | 0.90        | High        |
| 5. working well with classmates is something that students can do effectively.                    | 3.89        | 0.98        | High        |
| 6. enjoying helping classmates is something that many students experience.                        | 3.73        | 0.95        | High        |
| 7. being liked by classmates is a source of happiness for many students.                          | 3.62        | 0.97        | High        |
| <b>Category Mean</b>                                                                              | <b>4.01</b> | <b>0.63</b> | <b>High</b> |
| <b>Teacher Support</b>                                                                            |             |             |             |
| 1. giving personal attention to students is something teachers often do.                          | 3.41        | 0.99        | High        |
| 2. Trying very hard to help students shows teachers' dedication.                                  | 3.99        | 0.87        | High        |
| 3. being sensitive to students' feelings is a quality that teachers demonstrate.                  | 3.49        | 1.02        | High        |
| 4. helping students when they have problems with their studies is something teachers commonly do. | 3.98        | 0.84        | High        |
| 5. discussing with students helps build understanding between teachers and students.              | 4.13        | 0.88        | High        |
| 6. being interested in students' problems shows that teachers care.                               | 3.16        | 1.07        | Moderate    |
| 7. going around the classroom to discuss with students helps teachers understand their needs.     | 3.60        | 1.17        | High        |
| 8. asking questions helps enhance students' understanding.                                        | 4.24        | 0.81        | Very High   |
| <b>Category Mean</b>                                                                              | <b>3.75</b> | <b>0.72</b> | <b>High</b> |
| <b>Involvement</b>                                                                                |             |             |             |
| 1. talking about their ideas during discussions helps students express themselves.                | 3.55        | 1.06        | High        |
| 2. voicing their opinions during discussions is something students value.                         | 3.36        | 1.17        | High        |
| 3. being asked questions by teachers helps students stay                                          | 4.01        | 0.91        | High        |

|                      |                                                                                                                               |             |             |                  |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|------------------|
|                      | engaged.                                                                                                                      |             |             |                  |
| 4.                   | having their ideas and suggestions accepted during discussions makes students feel included.                                  | 3.83        | 0.93        | High             |
| 5.                   | asking teachers questions helps students understand better.                                                                   | 3.60        | 1.23        | High             |
| 6.                   | explaining their ideas to classmates helps deepen students' learning.                                                         | 3.83        | 0.97        | High             |
| 7.                   | discussing with classmates how to solve problems encourages teamwork.                                                         | 4.22        | 0.91        | Very High        |
| 8.                   | being asked to explain how to solve certain problems helps students build confidence.                                         | 4.04        | 0.94        | High             |
| <b>Category Mean</b> |                                                                                                                               | <b>3.81</b> | <b>0.73</b> | <b>High</b>      |
| <b>Cooperation</b>   |                                                                                                                               |             |             |                  |
| 1.                   | cooperating with their classmates to carry out a task helps students finish it effectively.                                   | 4.42        | 0.83        | Very High        |
| 2.                   | sharing books and other resources with their classmates supports students' learning.                                          | 4.14        | 0.79        | High             |
| 3.                   | demonstrating team spirit is something students consistently do when carrying out group work.                                 | 3.89        | 0.97        | High             |
| 4.                   | cooperating with their classmates to complete a class project is something students enjoy.                                    | 4.38        | 0.82        | Very High        |
| 5.                   | learning from their classmates helps students gain new perspectives.                                                          | 4.38        | 0.80        | Very High        |
| 6.                   | working on a task with their classmates builds teamwork skills.                                                               | 4.32        | 0.85        | Very High        |
| 7.                   | cooperating with their classmates is a regular part of students' school experience.                                           | 4.42        | 0.76        | Very High        |
| 8.                   | working together with their classmates to achieve common goals promotes unity and success.                                    | 4.26        | 0.89        | Very High        |
| <b>Category Mean</b> |                                                                                                                               | <b>4.28</b> | <b>0.65</b> | <b>Very High</b> |
| <b>Fairness</b>      |                                                                                                                               |             |             |                  |
| 1.                   | receiving equal attention from teachers for students' questions as their classmates' questions makes students feel respected. | 4.32        | 0.80        | Very High        |
| 2.                   | receiving help just like their classmates supports equal learning among students.                                             | 4.39        | 0.72        | Very High        |
| 3.                   | being given equal opportunity as their classmates to answer questions in class encourages students' participation.            | 4.33        | 0.75        | Very High        |
| 4.                   | being treated equally as their classmates helps students feel included.                                                       | 4.31        | 0.85        | Very High        |
| 5.                   | getting encouragement from teachers just like their classmates boosts students' motivation.                                   | 4.28        | 0.83        | Very High        |
| 6.                   | being given the same space and opportunity to contribute to classroom discussions promotes fairness among students.           | 4.29        | 0.83        | Very High        |
| 7.                   | receiving the same compliment for their work as their classmates makes students feel recognized.                              | 4.04        | 0.96        | High             |
| 8.                   | having the same opportunity as their classmates to answer questions in class helps build students' confidence.                | 4.16        | 0.89        | High             |

|               |      |      |           |
|---------------|------|------|-----------|
| Category Mean | 4.27 | 0.66 | Very High |
| Over-all Mean | 4.40 | 0.51 | Very high |

Table 3 shows the level of student engagement in mathematics, with an overall mean of 3.85 (interpreted as high) and a standard deviation of 0.79, indicating consistent engagement among participants. This suggests that students frequently demonstrate active participation and involvement in math learning, particularly in cognitive aspects.

Emotional Engagement had a category mean of 3.73, interpreted as high, indicating that students generally enjoy math and have positive emotional experiences, though there is some variability in daily enjoyment. Social Engagement had a category mean of 3.63, which is interpreted as high, indicating active peer collaboration and support during math tasks. Cognitive Engagement had a category mean of 4.19, indicating high engagement, reflecting students’ strong mental effort and commitment to learning mathematical concepts.

**Table 3**  
*Level of Student Engagement in Math*

|                                                                                                              | Mean        | SD          | Description |
|--------------------------------------------------------------------------------------------------------------|-------------|-------------|-------------|
| <b>Emotional Engagement</b>                                                                                  |             |             |             |
| 1. having fun in math class is an experience students encounter during their day.                            | 4.22        | 0.86        | Very High   |
| 2. feeling bored in math class is emotion students sometimes experience during their day.                    | 3.49        | 1.20        | High        |
| 3. enjoying thinking about math is part of students’ experiences during their day.                           | 3.27        | 1.10        | Moderate    |
| 4. finding learning math interesting is something students experience throughout their day.                  | 3.94        | 1.02        | High        |
| <b>Category Mean</b>                                                                                         | <b>3.73</b> | <b>0.79</b> | <b>High</b> |
| <b>Social Engagement</b>                                                                                     |             |             |             |
| 1. talking about math with other students in class is an activity students engage in during their day.       | 3.69        | 1.09        | High        |
| 2. helping other students with math when they encounter difficulties is part of students’ daily experiences. | 3.30        | 1.18        | Moderate    |
| 3. sharing ideas and materials with other students in math class is something that happens during the day.   | 3.52        | 1.13        | High        |
| 4. helping each other learn is a practice students demonstrate in math class.                                | 4.00        | 0.93        | High        |
| <b>Category Mean</b>                                                                                         | <b>3.63</b> | <b>0.88</b> | <b>High</b> |
| <b>Cognitive Engagement</b>                                                                                  |             |             |             |
| 1. working as hard as possible is what students aim to do in                                                 | 4.22        | 0.84        | Very High   |

|                                                                                              |      |      |           |
|----------------------------------------------------------------------------------------------|------|------|-----------|
| math class during the day.                                                                   |      |      |           |
| 2. understanding mathematics very well is important to students during their learning today. | 4.18 | 0.86 | High      |
| 3. trying to learn as much as possible in math class is a goal students set for themselves.  | 4.33 | 0.82 | Very High |
| 4. doing a lot of thinking in math class is part of the students' experience during the day. | 4.04 | 0.98 | High      |
| Category Mean                                                                                | 4.19 | 0.69 | High      |
| Over-all Mean                                                                                | 3.85 | 0.79 | High      |

Table 4 presents the relationships among student mathematics motivation, the learning environment, and student engagement in mathematics. A strong positive correlation was found between mathematics motivation and student engagement ( $r = .628$ ,  $p < .05$ ), indicating that higher levels of motivation are significantly associated with greater engagement in math.

Similarly, a positive and significant correlation was found between the learning environment and student engagement ( $r = .601$ ,  $p < .05$ ). This suggests that students who experience a more supportive and inclusive classroom environment tend to show higher levels of emotional, social, and cognitive engagement in mathematics learning.

**Table 4**  
*Significance of the Relationship of Student's Mathematics Motivation, Learning Environment, and Student Engagement in Math*

|                                                               | r    | p    | Remarks     |
|---------------------------------------------------------------|------|------|-------------|
| Student Mathematics Motivation and Student Engagement in Math | .628 | .000 | Significant |
| Learning Environment and Student Engagement in Math           | .601 | .000 | Significant |

Table 5 presents the results of the multiple regression analysis assessing the influence of mathematics motivation and the learning environment on student engagement in math. The model explains 52.6 percent of the variance in engagement ( $R^2 = 0.526$ ,  $p < .005$ ), indicating a strong combined predictive power.

Among the predictors, mathematics motivation had the strongest influence, with a standardized beta of 0.688, while the learning environment also significantly predicted engagement, with a beta of 0.492. These results confirm that both variables contribute positively and significantly to students' engagement in mathematics.

**Table 5**  
*Significance of the Influence of Student's Mathematics Motivation, Learning Environment, and Student Engagement in Math*

| Variables                                           | $\beta$ | t     | p    | Remarks     |
|-----------------------------------------------------|---------|-------|------|-------------|
| Student Math Motivation and Student Math Engagement | 0.688   | 10.16 | .000 | Significant |
| Learning Environment and Student Math Engagement    | 0.492   | 9.08  | .000 | Significant |
| <b>Holistic Model</b>                               |         |       |      |             |
| r <sup>2</sup>                                      | .526    |       |      |             |
| F-value                                             | 165     |       |      |             |
| P-value                                             | .000    |       |      | Significant |

DISCUSSION

This section interprets the results presented in the previous tables, linking the findings to existing literature and relevant theoretical frameworks. The discussion focuses on the levels of student mathematics motivation, the learning environment, and math engagement, as well as the significance of their relationships and predictive influences.

Each subsection highlights key patterns in the data, compares them with findings from previous studies, and explains their implications using Self-Determination Theory (SDT) and Ecological Systems Theory (EST). These insights aim to deepen the understanding of how motivational and environmental factors shape student engagement in mathematics and inform evidence-based educational strategies.

In Table 1, the results indicate that students in private Catholic senior high schools in Davao City generally exhibit high motivation in mathematics, driven by both intrinsic and extrinsic factors, and supported by positive perceptions of the subject. The high intrinsic motivation suggests that students value achievement and mastery in math, aligning with the findings by Dela Peña et al. (2022) and Mula and Naka (2024). However, some students still depend on teacher direction, as shown by lower scores in self-initiated learning. Extrinsic motivation remains a significant driver, especially in contexts of peer support and recognition, consistent with studies by Guvendir (2016) and Datu et al. (2024). The presence of moderate responses to reward-based or applicability-related items indicates variability in external influences. Positive

perceptions of mathematics support sustained engagement, as indicated by the high mean for the cognitive value of math. These findings support Shen and Talavera's (2023) findings, suggesting that students are aware of math's academic relevance. However, some responses indicate that students doubt their understanding of complex material, suggesting areas where instructional strategies could improve.

In Table 2, the results indicate that students experience a generally positive and supportive learning environment, particularly in cooperation and fairness, which are essential to engagement and classroom equity. These results align with studies by Salazar and Basierto (2021) and Lualhati et al. (2018), which emphasize the importance of collaborative and fair learning spaces. High levels of student closeness suggest strong interpersonal bonds among peers, reinforcing a safe learning environment, consistent with Martin et al. (2021). Teacher support, while rated high, varied slightly across items, pointing to areas where relational or emotional support may be further strengthened, echoing Khine et al. (2022). Students' involvement creates an active learning environment that provides opportunities for meaningful participation. The consistently very high mean in the cooperation and fairness category indicates that students feel their contributions are valued and that classroom interactions are equitable, which are key factors in promoting sustained engagement. Contrasting results from Tempiski et al. (2015) and Galang et al. (2024), which reported either very high or moderate levels in specific subdomains, suggest contextual differences between school types and levels. These findings reinforce the critical role of a well-balanced classroom environment in shaping student motivation and behavior.

In Table 3, the results indicate that students exhibit high levels of engagement in mathematics, with cognitive engagement as the most dominant domain. This suggests that learners are not emotionally or socially involved yet are deeply invested in understanding and mastering the mathematical concepts. High emotional engagement implies that students view math positively, aligning with studies by Fredricks et al. (2019) and Watt and Carmichel (2017). The moderate score on some emotional items indicates that engaging instructional strategies can still strengthen daily interest in math. The strong social engagement highlights collaborative classroom dynamics, consistent with findings from Ayub et al. (2021) and Lazarides and Rubach (2017), suggesting that peer interaction plays a vital role in enhancing math learning experiences. The very high cognitive engagement demonstrates the student's deep learning

orientation and aligns with Wang et al.'s (2016) research. These findings underscore that students are willing to invest intellectual effort, which can translate to improved performance and long-term academic success.

In Table 4, the results indicate that both student mathematics motivation Low (2022) the learning environment are significant predictors of student engagement in math. The strong correlation between motivation and engagement supports the findings of Low (2022) and Valenzuela-Penunuri et al. (2024), emphasizing that motivated students are more involved in academic tasks and learning activities. The positive relationship between the learning environment and engagement aligns with Gutierrez (2023), highlighting that a supportive classroom fosters student participation, collaboration, and interest in math. These findings are theoretically grounded in self-determination theory (Deci & Ryan, 1985), which explains that students are more engaged when self-determination theory, competence, and relatedness are met. Both internal motivation and external classroom support create these conditions. Additionally, Bronfenbrenner's Ecological Systems Theory underscores the classroom's important role as a microsystem in shaping students' academic behavior. A respectful, structured, and engaging learning environment fosters more profound student engagement in mathematics.

Table 5 shows that both internal and external factors significantly influence student engagement in math. Mathematics motivation emerged as the strongest predictor and aligns with self-determination theory (Deci & Ryan, 1985), which posits that intrinsic motivation enhances persistence, effort, and engagement in learning. The learning environment also played a meaningful role, validating Bronfenbrenner's ecological systems theory (1979), which emphasizes the influence of environmental systems, such as classroom dynamics, on students' development and behavior. A supportive, inclusive, and well-structured classroom setting contributes to student's sustained engagement.

## REFERENCES

- Amrai, K., & Motlagh, S. E. (2011). The relationship between academic motivation and academic achievement of students. *Journal of Applied Sciences*, 11(3), 599-602.
- Ayub, A. F. M., et al. (2021). The Relationship between Mathematics Motivation and Mathematics Achievement among Secondary School Students. *International Journal of Academic Research in Business and Social Sciences*, 11(10), 125-139.

- Bekker, T., et al. (2024). Student engagement and mathematical literacy in South Africa. *South African Journal of Education*, 44(1).
- Bronfenbrenner, U. (1979). *The Ecology of Human Development: Experiments by Nature and Design*. Harvard University Press.
- Carandang, G., et al. (2023). Factors affecting mathematics performance in Philippine schools. *Philippine Journal of Education*, 2(1).
- Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (4th ed.). Sage Publications.
- Datu, J. A. D., et al. (2024). Academic engagement and growth mindset in the Philippines. *Asian Journal of Social Psychology*, 27(1).
- Dayaganon, et al. (2023). Contextualization of mathematics instruction in Mindanao. *Journal of Mathematics Education in Mindanao*, 5(2).
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic Motivation and Self-Determination in Human Behavior*. Plenum.
- Dela Peña, L. A., Baluyos, G. R., Junior High School Department, Misamis University, & Misamis University. (2022). Intrinsic motivation as predictor of students' Mathematics Problem-Solving performance. In United International Journal for Research & Technology, *United International Journal for Research & Technology* (Vol. 04, Issue 01) [Journal-article]. <https://uijrt.com/articles/v4/i1/UIJRTV4I10009.pdf>
- Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School Engagement: Potential of the Concept, State of the Evidence. *Review of Educational Research*, 74(1), 59-109. <https://doi.org/10.3102/00346543074001059>
- Fredricks, J. A., et al. (2019). School engagement framework updates. *Educational Psychologist*.
- Gallup. (2016). *Thate of the American Student*. Gallup Education Report.
- Gutierrez, J. (2023). Teacher support and classroom engagement in Philippine private schools. *Philippine Journal of Education Research*, 10(2).
- Gutierrez, J., & Doronio, M. (2024). Peer influences on mathematics engagement. *Philippine Journal of Mathematics Education*, 12(1).
- Galang, B. R., Basco, J. G., & Graduate School, Republic Central Colleges (RCC), Angeles City, Philippines. (2025). RELATIONSHIP BETWEEN ACADEMIC ACHIEVEMENT AND PERCEIVED LEARNING ENVIRONMENT AMONG ELEMENTARY PUPILS. In *Ignatian International Journal for Multidisciplinary Research* (Vol. 2). <https://icceph.com/wp-content/uploads/2025/03/PERCEIVED-LEARNING-ENVIRONMENT.pdf>
- Güvendir, M. A. (2016). Students' Extrinsic and Intrinsic Motivation Level and its Relationship with their Mathematics Achievement. *International*



- Journal for Mathematics Teaching and Learning*, 17(1).  
<https://doi.org/10.4256/ijmtl.v17i1.9>
- Jin, L., et al. (2023). Supportive learning environments and student engagement in math. *Journal of Educational Research*, 56(3).
- Khine, M. S., Fraser, B. J., Afari, E., & Liu, Y. (2022). Language learning environments and reading achievement among students in China: evidence from PISA 2018 data. *Learning Environments Research*, 26(1), 31–50. <https://doi.org/10.1007/s10984-021-09404-8>
- Lualhati, G. & Batangas State University. (2018). What is Happening in your Class? Exploring Filipino Science Classroom Atmosphere. In *International Journal of Recent Innovations in Academic Research* (Vols. 2–7, Issue November-2018, pp. 207–218) [Journal-article]. <https://www.ijriar.com>
- Lazarides, R., & Rubach, C. (2017). Instructional practices and student engagement in mathematics. *Learning and Instruction*, 49, 1-10.
- Low, E. L. (2022). Teacher feedback and motivation. *Journal of Education*, 15(4).
- Martin, A. J., et al. (2021). Academic buoyancy and student engagement. *Journal of Educational Psychology*, 113(2), 220-235.
- Mädamürk, K., Upadyaya, K., Hietajärvi, L., Lonka, K., & Salmela-Aro, K. (2024). The importance of socio-emotional skills obtained before the COVID-19 pandemic in supporting study engagement during the pandemic and transition to higher education. *European Journal of Psychology of Education*, 40(1). <https://doi.org/10.1007/s10212-024-00898-3>
- Mula, M., Naka, L., & Sylhasi, F. (2024). Intrinsic and extrinsic motivation of primary school students for mathematics and English as a foreign language. *International Electronic Journal of Elementary Education*. <https://doi.org/10.26822/iejee.2024.372>
- Nurkarim, I., Jamaluddin, M., Rahman, A., & Hakim, R. (2023). Development and validation of the Student Mathematics Motivation Scale (SMMS): Exploring intrinsic goals, extrinsic goals, and perceptions of mathematics. *Journal of Educational Psychology and Assessment*, 15(3), 45-60.
- OECD. (2022). *PISA 2022 Results: Learning During – and from – Disruption*. OECD Publishing.
- Reyes, A. (2019). Challenges in mathematics education in the Philippines. *Journal of Philippine Education*, 8(2).
- Rodiana, R., & Laelasari, A. (2024). Intrinsic and extrinsic motivation in

- mathematical problem solving. *International Journal of Science and Math Education*, 19(2).
- Rahayu, W., Putra, M. D. K., Rahmawati, Y., Hayat, B., & Koul, R. B. (2021). Validating an Indonesian Version of the What Is Happening in this Class? (WIHIC) Questionnaire Using a Multidimensional Rasch Model. *International Journal of Instruction*, 14(2), 919–934. <https://doi.org/10.29333/iji.2021.14252a>
- Tempiski, P., Santos, I. S., Mayer, F. B., Enns, S. C., Perotta, B., Paro, H. B. M. S., Gannam, S., Peleias, M., Garcia, V. L., Baldassin, S., Guimaraes, K. B., Silva, N. R., Da Cruz, E. M. T. N., Tofoli, L. F., Silveira, P. S. P., & Martins, M. A. (2015). Relationship among Medical Student Resilience, Educational Environment and Quality of Life. *PLoS ONE*, 10(6), e0131535. <https://doi.org/10.1371/journal.pone.0131535>
- Salazar, D., & Basierto, M. (2021). Learning environments in Philippine Catholic institutions. *Journal of Catholic Education*, 14(1).
- Salva, P., et al. (2017). Mathematical literacy and student interest in Mindanao. *Mindanao Journal of Education*, 4(1).
- Seeram, E. (2019). An Overview of Quantitative Research. *Radiologic Technology*, 90(5), 441-447.
- Shen, Y., & Talavera, A. (2023). Academic relevance and math motivation. *Journal of Educational Studies*, 22(3).
- Torrejos, R. L. (2024). College students' engagement in mathematics in the modern world: the influential role of perceived teaching performance of instructors and critical thinking skills in a blended learning environment. *European Journal of Contemporary Education and E-Learning*, 2(3), 74–89. [https://doi.org/10.59324/ejceel.2024.2\(3\).07](https://doi.org/10.59324/ejceel.2024.2(3).07)
- Thomson, S., & Nye, C. (2021). International mathematics performance reports. Education Research Center.
- Valenzuela-Penunuri, et al. (2024). Mathematics motivation and academic success in senior high school. *International Journal of Educational Development*, 18(2).
- Wang, M. T., Fredricks, J. A., Ye, F., & Hofkens, T. L. (2016). The Math and Science Engagement Scales: Scale Development, Validation, and Psychometric Properties. Learning and Instruction. ScienceDirect Link: <https://www.sciencedirect.com/science/article/abs/pii/S0959475216300081>
- Watt, H. M. G., & Carmichel, C. (2017). Mathematics engagement and value orientations. *Educational Studies in Mathematics*, 96(3), 305-322.