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

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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.

Statement of the Problem

1. What is the level of student's mathematics motivation in terms of intrinsic motivation; extrinsic motivation; and perception about mathematics?
2. What is the status of learning environment in terms of student closeness; teacher support; involvement; cooperation; and fairness?
3. What is the level of student engagement in math in terms of emotional engagement; social engagement; and cognitive engagement?
4. Is there a significant relationship between students' mathematics motivation and student engagement, and learning environment and student engagement?
5. Do students' mathematics motivation and learning environment significantly influence student engagement?

METHODOLOGY

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 Considerations. 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.

RESULTS AND DISCUSSION

Level of Students' Mathematics Motivation

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.

Table 1

Level of Students' Mathematics Motivation

Indicators	Mean	SD	Description
Intrinsic Motivation	3.40	0.50	High
Extrinsic Motivation	3.77	0.56	High
Perception about Mathematics	3.66	0.59	High
Overall Mean	**3.61**	**0.55**	**High**

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.

Level of Learning Environment

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.

Table 2

Level of Learning Environment

Indicators	Mean	SD	Description
Student Closeness	4.01	0.63	High
Teacher Support	3.75	0.72	High
Involvement	3.81	0.73	High
Cooperation	4.28	0.65	Very High
Fairness	4.27	0.66	Very High
Overall Mean	**4.40**	**0.51**	**Very high**

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 Tempski 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.

Level of Student Engagement in Math

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.

Table 3

Level of Student Engagement in Math

Indicators	Mean	SD	Description
Emotional Engagement	3.73	0.79	High
Social Engagement	3.63	0.88	High
Cognitive Engagement	4.19	0.69	High
Overall Mean	**3.85**	**0.79**	**High**

This result 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.

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

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

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.

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

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	β	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
Holistic Model				
$_R2$	.526			
F-value	165			
P-value	.000			Significant

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). *Theatre 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 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

Tempski, 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

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.