



## CLASSROOM SOCIAL ENVIRONMENT AND STUDENT ENGAGEMENT IN MATHEMATICS: A CORRELATIONAL STUDY

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### **Abstract:**

This study investigated the association between classroom social environment and student engagement in mathematics. It utilized the descriptive correlational and causal-comparative research design and applied the following statistical tools: mean, Pearson-r, independent T-test, and Analysis of Variance (ANOVA). This investigation used an adapted, content-validated, and reliability-tested survey questionnaire. A proportional stratified random sampling technique was used to obtain a sample of 282 respondents from Manat National High School – Junior High School. The result of the study revealed that students often show high engagement with mathematics in emotional, social, and cognitive domains, with cognitive engagement peaking. The classroom social environment is favorable, with teachers providing support and mutual respect, even when performance goals are not as important. Moreover, the study revealed a significant correlation between engagement dimensions and classroom social environment, with a minor association between social environment quality and emotional and social engagement and a moderate correlation with cognitive engagement. The study found no significant differences in engagement based on sex and age, but observed substantial variation in engagement across different grade levels, suggesting that grade level significantly influences students' mathematics engagement. Based on the findings, it was highly recommended that teachers use techniques like acknowledging student accomplishments, offering constructive criticism, and creating a friendly learning environment to promote healthy mathematical learning. They should

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also encourage group projects, peer tutoring, and engaging mathematical tasks to enhance critical thinking and problem-solving skills. A respectful classroom culture and tailored engagement strategies were also suggested. School administrators should also conduct professional development workshops for teachers.

**Keywords:** classroom social environment, emotional engagement, social engagement, cognitive engagement, mathematics, descriptive correlational and causal-comparative study, Philippines

## 1. Introduction

Student engagement in mathematics remains a global educational concern due to the subject's perceived complexity and abstract nature, leading to widespread disinterest and low motivation among students (Cevikbas & Kaiser, 2022). This disengagement significantly impacts students' mathematical performance and overall achievement. Research has highlighted various factors influencing engagement, including classroom environment and instructional support. For instance, a study in Sweden by Castro-Kemp *et al.* (2015) found that emotional, instructional, and classroom support are crucial for fostering student engagement in mathematics.

Recent results from the Program for International Student Assessment (PISA) 2022, released by the Organization for Economic Cooperation and Development (OECD), underscore a significant challenge in the Philippines, where students ranked 76<sup>th</sup> out of 81 countries, with scores substantially below the OECD average. This highlights the urgent need to address the factors contributing to low engagement and performance in mathematics.

In the Philippines, Marpa (2016) identified attitudes toward mathematics and the competence of instructors as key predictors of student engagement. At Manat National High School, where only 56.77% of junior high students met the target proficiency in mathematics for the school year 2023-2024, it is evident that many students struggle with basic mathematical concepts and communication. The pandemic-induced shift to modular learning, which reduced academic and social interactions, further exacerbated this issue.

This study explored the relationship between classroom social environment and student engagement in mathematics. By understanding these dynamics, the research sought to develop strategies to enhance engagement and mathematical proficiency.

## 2. Literature Review

The classroom social environment plays a significant role in education and is connected to various adaptive student learning-related beliefs and actions. It includes aspects of teacher support, fostering mutual respect, fostering student task-related interaction, and fostering performance goals. It also includes students' impressions of how they feel encouraged to interact with others (Patrick & Ryan, 2005). Research indicates these

elements can be measured effectively and influence students' motivation, self-regulated learning, behavior, social interactions, and academic achievement (Ryan and Patrick, 2001). For instance, Cevikbas and Kaiser (2022) found that flipped learning, which emphasizes interaction and teamwork, positively affects student engagement in mathematics by providing various learning opportunities and fostering a supportive social environment.

To promote student engagement and motivation, teachers must be supportive. According to Patrick and Ryan (2005), students who feel that their teachers are interested, hardworking, and have a positive academic self-concept are more likely to follow classroom rules and ask for help when needed. Klem and Connell (2004) also found that supportive teacher-student relationships result in higher academic achievement and student engagement. Ruzek *et al.* (2016) found that emotionally supportive teacher-student interactions improve students' behavioral engagement and motivation.

Additionally, fostering mutual respect in the classroom is essential for creating an environment where students feel safe and valued, enabling them to focus on learning activities without fear of ridicule (Patrick & Ryan, 2005). Quin (2017) demonstrated that high-quality teacher-student relationships (TSRs) are consistently linked to increased student engagement and reduced disruptive behaviors. Respectful and supportive interactions between teachers and students can mitigate the negative effects of bullying and promote a positive social environment (Thornberg, 2013).

Moreover, encouraging task-related interactions among students is vital for student-centered learning approaches. These interactions, whether through whole-class discussions, small-group activities, or informal help-seeking, allow students to share ideas, justify decisions, and engage in meaningful conversations (Patrick & Ryan, 2005). Slavin (2010) emphasized that cooperative learning, which promotes mutual responsibility and support, leads to higher academic achievement and fosters critical thinking and teamwork.

Promoting performance goals, which emphasize competitiveness and comparative evaluations, can have mixed effects on student engagement. While performance goals can motivate some students, they can also lead to avoidance behaviors and increased anxiety (Urduan *et al.*, 2002). Linnenbrink (2005) found that a combination of mastery and performance goals positively impacts help-seeking and achievement, suggesting that a balanced approach may be most effective. Reducing social comparison and encouraging intrinsic motivation is essential for fostering a supportive classroom climate (Linnenbrink-Garcia *et al.*, 2016).

Student engagement, characterized by students' willingness and effort to participate in school activities, is crucial for academic achievement and future career success (Trowler, 2010; Christenson *et al.*, 2012). It encompasses motivation (Williams & Ivey, 2001) and can be divided into emotional, social, and cognitive dimensions (Rimm-Kaufmann, 2010). Despite increasing research, student engagement in mathematics remains underexplored, often focusing primarily on academic accomplishment (Trenholm *et al.*, 2018).

Research consistently shows a positive correlation between student engagement and mathematical achievement. Maamin *et al.* (2022) found that cognitive, affective, and behavioral engagement significantly impact students' mathematical performance, with affective engagement being the most significant predictor. Similarly, Delfino (2019) reported a substantial correlation between behavioral, emotional, and cognitive engagement and academic performance among university students in the Philippines.

Several factors influence student engagement in mathematics. Teacher support, particularly instructional support, significantly affects engagement, with female teachers showing a more substantial influence (Alrajeh & Shindel, 2020). The social and relational aspects of learning mathematics also play a crucial role (Roche *et al.*, 2021). Classroom culture has a greater impact on student participation than curriculum or teaching methods, highlighting the importance of fostering a conducive classroom atmosphere (Sullivan *et al.*, 2006).

The Student Engagement in Mathematics Scale (SEMS), developed by Rimm-Kaufman (2010), measures social, cognitive, and emotional engagement and has been validated in various studies (Kulik, 2023; Ioannou *et al.*, 2020; Sen, 2022; Zantua & Lapinid, 2018). Rimm-Kaufman *et al.* (2015) found that teacher-student interaction quality positively correlates with behavioral engagement, with structured and emotionally supportive classrooms fostering higher engagement levels.

Cross-national studies, such as Maulana *et al.* (2023), reveal that perceived teaching behavior strongly influences student engagement, with significant variations across different educational contexts. Notably, instructional support remains a critical factor even after controlling for emotional and organizational support (Alrajeh & Shindel, 2020). However, Ansong *et al.* (2017) found that teacher support did not directly predict student engagement, with peer and parental support playing more significant roles in Ghana.

Emotional engagement, encompassing students' attitudes, interests, and values, significantly impacts learning outcomes (Zorn *et al.*, 2022; Ansong *et al.*, 2017). Factors such as teacher support, classroom atmosphere, and peer interactions influence emotional engagement (Ryan & Patrick, 2001; Klem & Connel, 2004; Pekrun & Linnenbrink-Garcia, 2012). Positive emotional involvement enhances academic performance and fosters long-term learning commitment (Jang *et al.*, 2016).

Social engagement, involving positive student-teacher and peer interactions, reduces alienation and dropouts (Hoi & Hang, 2021; Pekrun & Linnenbrink-Garcia, 2012). Collaborative learning environments significantly enhance social engagement, improving academic achievement and social skills (Gillies, 2016; Johnson & Johnson, 2018).

Cognitive engagement, reflecting students' effort and willingness to comprehend material, is critical for academic success (Rimm-Kaufman *et al.*, 2015; Zorn *et al.*, 2022). High levels of cognitive engagement correlate with academic achievement, resilience, and self-regulated learning (Wang *et al.*, 2016; Zimmerman & Schunk, 2011). Online learning environments pose challenges for cognitive engagement, requiring effective

discussion forums and interaction levels (Guo *et al.*, 2023; Shukor *et al.*, 2014; Kew & Tasir, 2021).

Despite the extensive body of research on student engagement, there is a notable scarcity of studies conducted within the context of the Philippines. While global research has explored various dimensions of engagement, specific cultural, social, and educational dynamics of the Philippines remain underexamined. This gap highlights the need for localized research to understand how Filipino students engage with their learning environments, particularly in subjects like mathematics where engagement is crucial for academic success. Addressing this gap can provide valuable insights and contribute to developing strategies tailored to the unique needs of Filipino students, ultimately enhancing their educational outcomes.

This study was grounded in Johnmarshall Reeve's examination of student engagement from the perspective of Self-Determination Theory (2012), which was firmly rooted in the Self-Determination Theory developed by Ryan and Deci (2000). Reeve (2012) defined *engagement* as the degree to which a student actively participates in a learning activity. This construct was characterized by multiple dimensions, encompassing four unique yet strongly connected aspects. Assessing student engagement in learning activities entails evaluating various factors. These factors included the student's concentration, attention, and effort, which are indicators of behavioral engagement. Additionally, the presence of task-facilitating emotions like interest and the absence of task-withdrawing emotions such as distress were considered aspects of emotional engagement. Furthermore, utilizing advanced learning strategies rather than superficial ones indicated cognitive engagement. Lastly, the degree to which the student actively seeks to enhance the learning experience, rather than passively receiving it, was regarded as a measure of agentic engagement. In their study, Leis *et al.* (2015) and Rimm-Kaufman (2010) condensed the four engagement elements into three dimensions: emotional, social, and cognitive engagement.

In this study, the researcher used Reeve's framework to analyze how various elements of the classroom social environment affected student engagement in mathematics. This entailed investigating characteristics such as teacher support, which was critical for instilling a sense of competence and relatedness in students. A supportive teacher could increase students' emotional engagement by making them feel valued and driven. Similarly, establishing mutual respect in the classroom could create a healthy social atmosphere in which students feel comfortable and encouraged to participate, thereby increasing their social engagement.

The promotion of task-related interaction, which was consistent with cognitive engagement, was also considered in this study. Teachers could assist students in acquiring a better comprehension and mastery of mathematics by promoting teamwork and meaningful discussions about mathematical topics. Furthermore, focus on performance goals encouraged students to aim high and, as a result, increased their cognitive engagement by stimulating them to employ advanced learning techniques.

The study offered valuable insights into how teachers might establish a more supportive and successful learning environment for students by examining the

interactions between the dimensions of engagement and characteristics such as teacher support, mutual respect, task-related interaction, and performance goals.

Furthermore, this study investigated the relationship between the classroom social environment of junior high school learners and their engagement in learning mathematics. Specifically, it aimed to profile respondents based on sex, age, and grade level and assess the levels of classroom social environment in terms of teacher support, promoting mutual respect, task-related interaction, and performance goals.

In addition, this study examined respondents' levels of engagement in mathematics across emotional, social, and cognitive dimensions. It further explores whether there is a significant relationship between classroom social environment and engagement in mathematics, as well as differences in engagement based on sex, age, and grade level. The null hypotheses assert that there is no significant relationship between classroom social environment and engagement dimensions ( $H_{01}$ ) and that engagement does not significantly differ across demographic groups ( $H_{02}$ ).

The study's findings are expected to inform educators, administrators, and policymakers on enhancing classroom dynamics to foster better student engagement in mathematics, thereby improving academic outcomes and promoting a supportive learning environment.

### 3. Material and Methods

The study used descriptive correlational and causal-comparative research design to investigate the relationship between classroom social environment and student engagement in mathematics. Descriptive correlational research examines the degree of association between variables, while causal-comparative research compares two or more groups to identify similarities and differences. The study aimed to test the relationship between classroom social environment and student engagement in mathematics. Also, it sought to investigate the difference in student engagement in mathematics when grouped according to sex, age, and grade level.

The respondents of this study were the 282 junior high school students of Manat National High School who were enrolled for the school year 2023-2024. They were chosen using a proportional stratified random sampling technique. It is a probability sampling technique that involves the division of the total population into distinct subgroups or strata. The researcher then proceeded to randomly choose subjects from each stratum in proportion to their representation in the population. This methodology enabled the researcher to acquire a sample population that accurately reflects the population under investigation.

The researcher used an adapted questionnaire to measure the classroom social environment of students learning mathematics. The first set of questionnaires was adapted from a questionnaire developed by Patrick and Ryan (2005) and modified to suit the local context. The questionnaire included 23 items distributed across four indicators: teacher support, promoting mutual respect, promoting task-related interaction, and promoting performance goals. The second set of questionnaires was

adapted and patterned from the Student Engagement in Mathematics Scale (SEMS) by Rimm-Kaufman (2010). It focused on measuring student engagement in learning mathematics using the three identified indicators, namely emotional, social, and cognitive engagement. Respondents rated their engagement in learning the subject using 4 to 5 items per indicator. A panel of experts validated the content of the questionnaires. It was then pilot-tested to the twenty respondents to test the validity and reliability and was measured using Cronbach Alpha.

Then, an official letter of request addressed to the Office of the School Division Superintendent of Davao de Oro, as well as the Office of the Public Schools District Supervisor of Nabunturan East and the School Principal of Manat National High School was submitted to secure authorization to conduct the proposed study. Also, a copy of the proposed study and the validated research questionnaire were submitted to the Office of the Research Development and Publication Center of Assumption College of Nabunturan for the approval of the Ethics Review Committee.

After securing the approval of the education heads and the school's Ethics Review Committee, the researcher facilitated the distribution and administering of the survey instrument to the selected student respondents. They were provided with information regarding their participation in answering the survey questionnaire. Additionally, the researcher adhered to appropriate ethical guidelines when conducting the study. Subsequently, the research instruments were retrieved, and all responses were collated and tallied in preparation for statistical treatment. Afterwards, the data were subjected to analyses and interpretation.

The study used the Statistical Package for the Social Sciences (SPSS) software to analyze and interpret collected data. Statistical tools employed include frequencies and percentages to determine the data frequency distribution, weighted mean to describe the level of classroom social environment and student engagement in mathematics, Pearson Product-Moment Correlation Coefficient to determine the relationship between the classroom social environment and student engagement in mathematics, and independent T-test and One-Way Analysis of Variance (ANOVA) to determine the significant differences between the means of three demographic groups – sex, age, and grade level.

#### **4. Results and Discussion**

The results are provided following the intended goals established for this investigation. Moreover, the study includes disclosing the null hypothesis's overall conclusion. In addition, this research incorporates a thorough review of the relevant scholarly literature to support and validate its findings.

##### **4.1. Level of Classroom Social Environment**

The level of respondents' classroom social environment as presented in Table 1, is measured in terms of the following indicators: (1) teacher support; (2) promoting mutual respect; (3) promoting task-related interaction; (4) promoting performance

goals. The overall weighted mean is 3.12, which indicates a *very satisfactory* level. The indicator “promoting mutual respect” has the highest mean score of 3.39 with a descriptive rating of “agree”. On the other hand, the indicator “promoting performance goals” has the lowest mean score of 2.52 with a descriptive rating of “agree”.

**Table 1: Level of Classroom Social Environment**

Indicators	Weighted Mean	Descriptive Rating
1. Teacher Support	3.35	Agree
2. Promoting Mutual Respect	3.39	Agree
3. Promoting Task-Related Interaction	3.22	Agree
4. Promoting Performance Goals	2.52	Agree
<b>Overall Mean</b>	<b>3.12</b>	<b>Very Satisfactory</b>

The findings revealed that, in general, respondents perceive their classroom social environment as very satisfactory. They believe there is a good atmosphere in learning, particularly in promoting mutual respect in the classroom and teacher support. This is essential because students demonstrate more effort and notable academic achievement when they find their teachers encouraging and respectful (Kosel, 2010).

However, as reflected in the results, fostering task-related interaction and promoting performance goals have slightly lower agreement levels, suggesting areas for improvement in the classroom social environment. This should be addressed effectively by employing cooperative learning approaches, which were found to significantly impact students’ higher academic achievement, as revealed in the studies of Johnson and Johnson (2018) and Slavin (2010). Also, for the best student performance, research by Cohen and Garcia (2008) highlights the need to develop intrinsic motivation for students and concentrate on mastery goals aside from fostering performance goals. This implies that when goals are not counterbalanced with an emphasis on mastery and personal development, they may hinder intrinsic motivation and long-term learning outcomes.

#### 4.2. Level of Student Engagement in Mathematics

As reflected in Table 2, the overall mean level of student engagement in mathematics is 3.12, indicating a *very satisfactory* level. Students’ cognitive engagement in learning mathematics has the highest mean score of 3.47, followed by emotional engagement with a mean score of 2.98. Social engagement, with a weighted mean of 2.92, has the lowest mean score. All three engagement dimensions have a descriptive rating of “often true”.

**Table 2: Level of Student Engagement in Mathematics**

Indicators	Weighted Mean	Descriptive Rating
1. Emotional Engagement	2.98	Often True
2. Social Engagement	2.92	Often True
3. Cognitive Engagement	3.47	Often True
<b>Overall Mean</b>	<b>3.12</b>	<b>Very Satisfactory</b>



The study's findings implied that students exhibit varying levels of engagement in mathematics across emotional, social, and cognitive dimensions, with the highest engagement observed in cognitive aspects.

Although students frequently perceived mathematics as engaging and entertaining, analysis showed that their emotional engagement in the subject was not as high as their cognitive engagement. On the other hand, a mean score of almost three indicates that students are likely to feel positive emotions when studying mathematics, which keeps them motivated and interested. A study by Mega, *et al.* (2014) corroborates this, showing that motivation and academic achievement are positively correlated with positive emotions during learning.

Moreover, in mathematics classes, students were frequently engaged in cooperative activities, lent a hand to one another, and exchanged ideas, as reflected in the study's findings. This level of social engagement, though slightly lower than emotional engagement, indicates a strong collaborative atmosphere in the classroom characterized by regular peer assistance and interaction. Such collaborative learning spaces, according to Gillies (2016), promoted social skills in addition to academic performance.

Students' cognitive engagement was remarkably high, suggesting they put in full effort, prioritize comprehension, and actively think about mathematics. High levels of students' cognitive engagement are linked to the application of deep learning techniques and improved academic performance, according to research by Wang *et al.* (2016). Furthermore, the importance of self-regulated learning – a fundamental element of cognitive engagement – for academic achievement was emphasized by Zimmerman and Schunk (2011). When taken as a whole, these results highlight how critical it is to promote cognitive engagement to improve learning outcomes and academic achievement.

### 4.3. Relationship Between Classroom Social Environment and Emotional Engagement

The association between respondents' perceptions of their classroom social environment and their emotional engagement in mathematics was tested at a significance level of 0.05. Table 3 presents that the correlation analysis between these variables yielded a p-value of 0.006 and a correlation coefficient of 0.164.

**Table 3:** Correlation Analysis between Classroom Social Environment and Emotional Engagement in Mathematics

Variables	Mean	Standard Deviation	P-value	Correlation Coefficient	Decision
Classroom Social Environment	3.12	0.26	0.006	0.164	Reject H <sub>0</sub> Significant
Emotional Engagement	2.98	0.69			

The study found a significant relationship between classroom social environment and emotional engagement in mathematics. This suggests that as the social environment quality of the classroom improves, students tend to exhibit slightly higher emotional engagement in mathematics. Findings of previous studies firmly confirm this result.

Ryan and Patrick (2001) state that changes in student engagement in learning are closely linked to their perceptions of teacher support and teachers' role in fostering task-related interaction and mutual respect. This underlines the importance of a supportive teacher-student connection in boosting emotional engagement. Similarly, Klem and Connell (2004) discovered a direct correlation between student engagement and teacher support, stressing that students who feel supported by their teachers tend to engage emotionally with their academics.

Further confirming this notion, Zhao and Kuh (2004) observed that participation in a learning community positively correlates with student engagement, self-reported outcomes, and overall learning satisfaction. These findings underscore the value of a cohesive and supportive social environment in fostering students' emotional engagement. When students feel part of a supportive learning community, they are more likely to invest emotionally in their educational experiences, leading to higher comprehension and retention of material.

#### 4.4. Relationship Between Classroom Social Environment and Social Engagement

Presented in Table 4 is the result of the correlation analysis between the respondents' perceptions of their classroom social environment and their social engagement in mathematics at a 0.05 level of significance. The table shows that the p-value is 0.000, and the correlation coefficient is 0.218.

**Table 4:** Correlation Analysis Between Classroom Social Environment and Social Engagement in Mathematics

Variables	Mean	Standard Deviation	P-value	Correlation Coefficient	Decision
Classroom Social Environment	3.12	0.26	0.000	0.218	Reject Ho; Significant
Social Engagement	2.92	0.59			

The results revealed a significant relationship between classroom social environment and social engagement in mathematics. This suggests that as the perceived quality of the classroom social environment improves, students show a slight increase in social engagement in learning mathematics.

The studies of Finn and Zimmer (2012) and Lu and Churchill (2012) aligned with these findings. According to their investigations, high-quality peer interactions focused on educational content significantly increase social engagement in learning. This means that students' social engagement increases when they form connections, share ideas, and work together with others to co-construct knowledge through learning activities.

Moreover, the study by Gillies (2016) emphasizing task-related interactions in the form of collaborative learning, which can improve not only the academic performance of students but also their critical social skills, further supports the study's results.

#### 4.5. Relationship Between Classroom Social Environment and Cognitive Engagement

The correlation analysis between the respondents' perceptions of their classroom social environment and their cognitive engagement in mathematics at a 0.05 level of significance is presented in Table 5. The table shows that the p-value is 0.000 and the correlation coefficient is 0.218.

**Table 5:** Correlation Analysis between Classroom Social Environment and Cognitive Engagement in Mathematics

Variables	Mean	Standard Deviation	P-value	Correlation Coefficient	Decision
Classroom Social Environment	3.12	0.26	0.000	0.278	Reject Ho <sub>1</sub> Significant
Cognitive Engagement	3.47	0.50			

The study found a significant relationship between classroom social environment and cognitive engagement in mathematics. This suggests that as the perceived quality of the classroom social environment improves, students tend to demonstrate a higher level of cognitive engagement in mathematical activities.

The literature provides strong support for the study findings. In the study of Wilson (2021), students' cognitive engagement is increased when they have the chance to create goals, make plans, evaluate their progress, and reflect on what they have learned. This shows that higher levels of cognitive engagement can be fostered in a classroom setting that values students' interests, fosters student-centered learning and promote intellectual challenges.

Furthermore, cognitive engagement involves self-directed learning and the innate urge to manage tasks, demonstrate flexibility in problem-solving, link concepts, and acquire complex understanding (Rimm-Kaufman *et al.*, 2015; Zorn *et al.*, 2022). This emphasizes how crucial it is to create a safe space in the classroom where students actively interact with the information they are studying. Students are more likely to be cognitively engaged in an environment that honors their intrinsic motives and encourages self-directed learning.

#### 4.6. Significant Difference in Student Engagement in Mathematics When Grouped According to Sex

The result of the Independent T-test conducted to test if there is a significant difference in student engagement in mathematics when grouped according to sex is presented in Table 6. It can be seen from the table that the p-value of 0.76 exceeds the significance level of 0.05, indicating that the null hypothesis is accepted.

**Table 6:** Comparison of Student Engagement  
 in Mathematics When Grouped According to Sex

Sex	Mean	P-value	Decision
Male	3.11	0.76	Accept Ho <sub>2</sub> Not Significant
Female	3.13		

The findings revealed no significant difference in the scores between males and females. This means that there is insufficient evidence that sex has a significant effect on student engagement in mathematics. Multiple research findings confirm the study's results, while some studies provide contradicting data.

A study by Maulana *et al.* (2023), which investigated the connection between student engagement and perceived teaching behavior, showed a strong positive association between student engagement and perceived teaching conduct in various educational circumstances. Crucially, they discovered that students' sex does not significantly affect the association, indicating that instructional style had the same effect on engagement regardless of sex.

Similarly, Fatou and Kubiszewski (2018) examined the relationship between perceived school climate and student engagement, concentrating on aspects of the larger school environment and the relationship between students and teachers. Their findings revealed a significant correlation between student engagement and the characteristics of the school environment, but this association was not affected by sex and social background.

However, other research offers contradicting data. Studies by Amir *et al.* (2014) and Hartono *et al.* (2019) noted variations in student engagement based on sex. According to their findings, female students reported higher levels of engagement than male students. These findings highlight the complexity of students' learning engagement and suggest that teachers should adopt inclusive teaching techniques.

#### 4.7. Significant Difference in Student Engagement in Mathematics When Grouped According to Age

The findings of the One-Way Analysis of Variance (ANOVA) used to determine whether student engagement in mathematics differs significantly depending on age grouping is displayed in Table 7. It can be seen from the table that the null hypothesis is accepted since the p-value of 0.44 is greater than the significance level of 0.05.

**Table 7:** Comparison of Student Engagement  
 in Mathematics When Grouped According to Age

Age	Mean	P-value	Decision
11 to 12 years old	3.18	0.44	Accept Ho <sub>2</sub> Not Significant
13 to 14 years old	3.15		
15 to 16 years old	3.08		

The findings revealed no significant difference in the mean scores across the three age groups. This suggests that age does not substantially affect student engagement in

mathematics. While some research findings contradict this result of the study, other research findings support the same conclusion.

In the investigation of Maulana *et al.* (2023) on the connection between perceived teaching behavior and student engagement involving six countries – the Netherlands, Spain, Indonesia, South Korea, South Africa, and Turkey – it was found that excellent teaching behavior favorably improved engagement regardless of students' age, thus supporting the study's findings.

However, information from other countries casts doubts on this conclusion. According to research done in Malaysia by Amir *et al.* (2014), age has a major impact on students' engagement in learning. Accordingly, younger children were more engaged in their studies than their older counterparts. This pattern was linked to children growing older and finding school activities less exciting and relevant. According to the study, younger children are more engaged because they have lower expectations for their academic performance and are more eager to please. Similarly, Lietaert *et al.* (2014) discovered that as students aged, their views of the classroom altered, which greatly affected their degrees of participation.

#### 4.8. Significant Difference in Student Engagement in Mathematics When Grouped According to Grade Level

The result of the One-Way Analysis of Variance (ANOVA) performed to establish if grade level substantially affects student engagement in mathematics is displayed in Table 8. A p-value of 0.000, which is less than the significance level of 0.05, indicates that the null hypothesis is rejected.

**Table 8:** Comparison of Student Engagement in Mathematics When Grouped According to Age

Grade Level	Mean	P-value	Decision
Grade 7	3.24	0.000	Reject Ho <sub>2</sub> Significant
Grade 8	3.15		
Grade 9	2.89		
Grade 10	3.21		

The study found a significant difference in the mean scores of student engagement in mathematics across the four grade levels. This suggests that students' grade level substantially affects their engagement in learning mathematics.

Several studies corroborate the study's findings. In the study of Hartono *et al.* (2019) about student participation among Indonesian high school students, grade 10 learners showed higher levels of engagement in learning compared to the learners in grades 11 and 12. This supports the idea that students' excitement and engagement levels in mathematics range greatly between grade levels.

Zorn *et al.* (2022) further support the study's findings by stating that as students advance through the grade levels, there is a shift in their engagement dynamics

corresponding with the modifications in the teaching strategies and students' developmental stages.

## 5. Recommendations

Based on the thorough discussion of the findings of the study, the following recommendations are presented:

- 1) Teachers should use techniques like acknowledging student accomplishments, offering constructive criticism, and creating a friendly learning environment to foster emotional bonds and promote healthy mathematics learning.
- 2) Encourage group projects, peer tutoring sessions, and cooperative learning activities to enhance social interaction and foster community among students.
- 3) Implement engaging mathematical tasks for students to enhance their critical thinking and problem-solving skills, while tailoring instructions to their diverse cognitive abilities for motivation.
- 4) Foster a respectful classroom culture, focusing on creating and meeting performance goals to inspire students to achieve greater academic success.
- 5) Implement engagement strategies tailored to students' developmental stages and unique requirements at different grade levels to maximize mathematics involvement and promptly address any new issues.
- 6) School administrators should conduct professional development workshops for teachers on improving student engagement, focusing on emotional, social, and cognitive aspects, and exchanging successful teaching techniques for fostering interest in mathematics.
- 7) Future researchers may use the study result as a basis for future data, especially about student engagement in mathematics and the classroom social environment.

## 6. Conclusion

The study's findings provide an extensive knowledge of how students interact with mathematics and the influence of the social environment in the classroom. In general, participants frequently exhibit somewhat high levels of engagement with mathematics in emotional, social, and cognitive domains, where cognitive engagement is at its peak. The social environment in the classroom is seen favorably, with teachers providing good support and a strong sense of mutual respect, even when performance goals aren't as important.

The correlation study shows that the three engagement dimensions and the social environment in the classroom are significantly correlated. To be more precise, there is a minor association between the quality of the social environment and emotional and social involvement and a moderate correlation with cognitive engagement. This implies that enhanced social environments in the classroom may result in increased levels of engagement, especially in cognitive engagement.

The study found no statistically significant differences in student engagement in mathematics according to age or sex. However, there is a notable variation in the degrees of engagement among students across different grade levels, suggesting that grade level plays a crucial role in determining students' mathematical engagement.

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### **Conflict of Interest Statement**

The authors declare no conflicts of interest.

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