

Peer Tutoring as an Intervention Strategy for Students' Engagement and Performance in Mathematics

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Abstract—This study examines the effectiveness of peer tutoring as an intervention strategy on students' engagement and performance in mathematics. Specifically, it sought to assess the level of peer tutoring implementation in terms of learning interaction, support focus, structured guidance, and social interaction; determine the level of students' behavioral, emotional, cognitive, and social engagement; evaluate students' mathematics performance through summative assessments; and examine the relationship and effect of peer tutoring on students' engagement and academic performance in mathematics. The study employed a quantitative, descriptive-correlational design involving 72 Grade 7 student respondents from Cristobal S. Conducto Memorial Integrated National High School, selected through purposive sampling. Data were gathered using the validated Peer Tutoring Questionnaire, Students' Engagement Questionnaire, and Mathematics Performance Assessment. Weighted mean, standard deviation, Pearson Product-Moment Correlation, and regression analysis were used to analyze the collected data. The findings revealed that peer tutoring was implemented at a very high level across learning interaction, support focus, structured guidance, and social interaction. Similarly, students demonstrated a very high level of behavioral, emotional, cognitive, and social engagement in mathematics. The results also showed that students achieved very satisfactory to outstanding levels of performance in mathematics assessments. Furthermore, peer tutoring was found to have a significant relationship with students' engagement and a positive effect on their mathematics performance. The study reveals that peer tutoring has significant relationship with students' engagement, particularly in social and behavioral dimensions and a significant effect on mathematics performance when implemented as a complete intervention strategy. Therefore, the result provides sufficient evidence to reject both null hypotheses, indicating that peer tutoring embodies activities that contributes positively to the students to become more engage in class at the same time, it introduced different competencies needed for improved performance in mathematics. It is recommended that teachers, school administrators, and curriculum planners continuously support and integrate peer tutoring activities in mathematics instruction to further enhance students' engagement and academic performance. Future researchers may also conduct related studies using larger populations and additional variables to further strengthen and validate the study's findings.

Keywords— Peer tutoring, intervention strategy, student engagement, mathematics performance, collaborative learning, academic achievement, structured guidance.

I. INTRODUCTION

Mathematics is an essential subject that develops students' critical thinking, logical reasoning, and problem-solving skills, which are necessary for academic success and everyday life.

However, many students continue to struggle with understanding mathematical concepts, resulting in low participation, low confidence, and poor academic performance. These challenges emphasize the importance of implementing instructional strategies that promote active participation and meaningful learning experiences among learners.

One learner-centered strategy that has gained significant attention is peer tutoring, where students support and assist one another in the learning process. Peer tutoring encourages collaboration, communication, and active interaction among students, allowing them to exchange ideas and solve mathematical problems together. In this study, peer tutoring serves as the independent variable and is examined in terms of learning interaction, support focus, structured guidance, and social interaction. These dimensions highlight the importance of collaboration, organized instruction, academic support, and positive peer relationships in creating an effective learning environment.

The study's dependent variables are students' engagement and performance in mathematics. Student engagement is explored across its behavioral, emotional, cognitive, and social dimensions, while mathematics performance refers to students' academic achievement as measured by assessments and learning outcomes. Existing studies suggest that peer tutoring positively influences students' motivation, participation, confidence, and academic achievement by fostering collaborative, interactive learning experiences.

Despite the recognized benefits of peer tutoring, many students in the local context still encounter challenges in mathematics, including low classroom participation and difficulties in understanding lessons. These concerns prompted the researcher to explore peer tutoring as an intervention strategy that may provide a more supportive, interactive, and learner-centered approach to mathematics instruction. Thus, this study aims to determine the effectiveness of peer tutoring in enhancing students' engagement and performance in mathematics, and to provide valuable insights that may help educators improve instructional practices and learning outcomes.

Hence, this study aims to determine the effectiveness of peer tutoring as an intervention strategy on students' engagement and performance in mathematics. Specifically, it seeks to examine the level of peer tutoring implementation in

terms of learning interaction, support focus, structured guidance, and social interaction, as well as its relationship to students' behavioral, emotional, cognitive, and social engagement and their performance in mathematics. Ultimately, the study hopes to provide meaningful insights that may help teachers, school administrators, and future researchers develop more effective instructional strategies that foster active participation, collaborative learning, and improved academic achievement among students.

1.1 Statement of the Problem

Problem/s which were addressed by the research

This study aimed to examine how certain peer tutoring as intervention strategies affect the engagement and math performance of Grade 7 learners. It examined whether using these strategies can significantly increase students' participation in class and improve their math scores.

Specifically, the study sought to answer the following questions:

1. What is the level of peer tutoring as an intervention strategy in terms of:
 - 1.1 Learning Interaction
 - 1.2 support focus
 - 1.3 structure guidance and
 - 1.4 social interaction?
2. What is the level of STUDENTS' ENGAGEMENT in Mathematics in terms of:
 - 2.1 Behavioral
 - 2.2 emotional
 - 2.3 cognitive and
 - 2.4 social?
3. What is the level of students' performance in Mathematics in terms of the Summative test?
4. Is there a significant relationship between peer tutoring as an intervention strategy and students' engagement in Mathematics?
5. Does peer tutoring as an intervention strategy have a significant effect on students' performance in Mathematics?

II. METHODOLOGY

The study employed a quantitative, descriptive-correlational design involving 72 Grade 7 student respondents from Cristobal S. Conducto Memorial Integrated National High School, selected through purposive sampling. Data were gathered using the validated Peer Tutoring Questionnaire, Students' Engagement Questionnaire, and Mathematics Performance Assessment. Weighted mean, standard deviation, Pearson Product-Moment Correlation, and regression analysis were used to analyze the collected data.

III. RESULTS AND DISCUSSION

This part presents, analyzes, and interprets the data collected, which show a significant relationship between the use of Peer Tutoring as an intervention strategy and students' engagement, along with their performance in Mathematics.

Level of Peer Tutoring as an Intervention Strategy

In this study, the term refers to a teaching strategy in which students (tutors) assist their classmates (tutees) in understanding and mastering mathematical concepts, skills, and problem-solving through structured guidance and collaborative learning. The level of use of peer tutoring as an intervention strategy in terms of learning interaction, support focus, structure and guidance, and social interaction was analyzed statistically using means and standard deviations.

Table 1 presents the level of use of Peer Tutoring as an Intervention Strategy in terms of Learning Interaction, including several indicators with their corresponding means, standard deviations, and remarks.

The results demonstrate that teachers exhibited a very high level of effectiveness in the use of peer tutoring techniques to promote learning interactions with their students. Teachers were able to provide organized directions to students prior to the peer tutoring sessions, give facilitated examples of effective explanation techniques, and create structured procedures for ensuring that sessions were conducted in an orderly manner.

A weighted mean of 4.58 and a standard deviation of 0.53 indicate that the majority of respondents interpret the peer tutoring experience to be interactive when guided properly by the teacher.

Table 1. Level of using Peer Tutoring as Intervention Strategy in Terms of Learning Interaction

Statement	Mean	SD	Remarks
My teacher...			
...provides structured directions prior to implementing peer tutoring activities.	4.51	0.50	Strongly Agree
...facilitates and models effective explanation strategies for peer tutors to use during lessons.	4.61	0.49	Strongly Agree
...implements systematic procedures to ensure peer tutoring sessions follow organized steps.	4.53	0.65	Strongly Agree
...directs and supports learners in maintaining active engagement during peer tutoring sessions.	4.51	0.58	Strongly Agree
...supervises and evaluates peer tutoring activities to maintain organization and focus	4.74	0.44	Strongly Agree
Weighted Mean	4.58		
SD	0.53		
Verbal Interpretation	Very High		

In summary, this study has demonstrated that peer tutoring is an effective approach for increasing formal learning interactions. Overall, teachers' high ratings on peer tutoring provide evidence that teachers can effectively implement peer-tutoring programs to increase students' active involvement in learning mathematics and to improve their communication and understanding of mathematical concepts through a collaborative learning process.

Table 2 presents the level of using peer tutoring as an intervention strategy in terms of support focus, including the corresponding mean, standard deviation, and descriptive remarks for each indicator. The results indicate that teachers demonstrated a very high level of effectiveness in implementing support-focused peer tutoring practices.

Specifically, teachers provided clear and organized instructions prior to the sessions, modeled effective explanation strategies, and established structured procedures

to ensure that peer tutoring activities were conducted in an orderly and meaningful manner.

Table 2. Level of using Peer Tutoring as Intervention Strategy in Terms of Support Focus

Statement	Mean	SD	Remarks
My teacher...			
...selects and designates peer tutors based on their willingness and capability to assist classmates.	4.44	0.55	Strongly Agree
...facilitates and maintains a supportive environment for students during peer tutoring activities.	4.49	0.56	Strongly Agree
...models and promotes patience and respectful interactions among peer tutors and tutees.	4.53	0.58	Strongly Agree
...stimulates and reinforces cooperative engagement among students during peer tutoring sessions.	4.54	0.60	Strongly Agree
...designs and sustains a positive and inclusive learning environment using peer tutoring strategies.	4.57	0.58	Strongly Agree
Weighted Mean	4.51		
SD	0.57		
Verbal Interpretation	Very High		

The computed weighted mean ($M = 4.51$, $SD = 0.57$) indicates that respondents strongly agreed that peer tutoring was effectively implemented in terms of support focus. The relatively low standard deviation suggests that responses were consistent, reflecting a shared perception among students regarding the effectiveness of teacher-guided peer tutoring sessions.

In summary, the results demonstrate that peer tutoring is highly effective in promoting structured, supportive learning environments. The high ratings reflect teachers' ability to facilitate meaningful peer interactions, which, in turn, enhance students' active participation, communication skills, and understanding of mathematical concepts through collaborative learning.

The findings from Table 3 indicate that teachers are highly effective in using peer tutoring to guide student learning. By providing clear instructions, modeling how to explain concepts, and establishing organized procedures, teachers create an environment where students can actively participate and collaborate.

The high weighted mean of 4.58 and low standard deviation of 0.55 suggest that most students perceive peer tutoring as an engaging and structured learning experience, highlighting its value in improving both understanding and communication in mathematics.

Overall, peer tutoring, when properly guided, fosters meaningful interactions that enhance students' learning outcomes.

The results in Table 4 reveal that teachers are highly effective in using peer tutoring to foster social interaction and learning among students. By giving clear instructions, modeling good explanation techniques, and guiding structured peer interactions, teachers help students engage meaningfully with one another.

The high weighted mean of 4.58 with a relatively low standard deviation of 0.56 shows that most respondents

strongly agree that peer tutoring when properly facilitated, creates interactive and collaborative learning experiences, improving students' communication and understanding of mathematics. In summary, peer tutoring not only enhances academic engagement but also supports positive social interaction in the classroom.

Table 3. Level of using Peer Tutoring as an Intervention Strategy in Terms of Structure Guidance

Statement	Mean	SD	Remarks
My teacher...			
...implements peer tutoring strategies to stimulate active learner participation during class activities.	4.64	0.48	Strongly Agree
...facilitates opportunities for students to pose questions and clarify understanding during peer tutoring.	4.60	0.55	Strongly Agree
...guides peer discussions to enhance comprehension and understanding of the lesson.	4.63	0.54	Strongly Agree
...promotes reciprocal teaching by having students articulate and explain concepts to peers.	4.50	0.56	Strongly Agree
...designs and facilitates interactive learning experiences that foster meaningful peer engagement.	4.54	0.63	Strongly Agree
Weighted Mean	4.58		
SD	0.55		
Verbal Interpretation	Very High		

Table 4. Level of using Peer Tutoring as an Intervention Strategy in Terms of Social Interaction

Statement	Mean	SD	Remarks
My teacher...			
...implements peer tutoring strategies to foster teamwork and collaborative skills among students.	4.56	0.53	Strongly Agree
...models and reinforces respectful communication to enhance positive peer interactions.	4.60	0.52	Strongly Agree
...facilitates activities that develop positive peer relationships and social connections.	4.60	0.57	Strongly Agree
...implements inclusive strategies to engage all learners during peer tutoring sessions.	4.60	0.57	Strongly Agree
...establishes and maintains expectations to encourage positive behavior throughout peer tutoring sessions.	4.54	0.60	Strongly Agree
Weighted Mean	4.58		
SD	0.56		
Verbal Interpretation	Very High		

Level of Students' Engagement

In this study, the term refers to the level of students' engagement in mathematics learning through peer tutoring. It focuses on how students respond to collaborative learning in terms of their interest, participation, motivation, confidence, and emotional involvement during math sessions. The data are systematically analyzed using the mean, standard deviation, and verbal interpretation to provide a clear understanding of students' learning experiences. Furthermore, the interpretation is supported by relevant literature to explain how peer tutoring influences students' engagement and overall learning behavior in mathematics.

Table 5 presents the level of students' behavioral engagement in Mathematics during peer tutoring activities. The data revealed a weighted mean of 4.37 with a standard

deviation of 0.62, interpreted as Very High. This indicates that the students consistently demonstrated strong behavioral engagement across participation, attention, collaboration, and task completion. The relatively small variation in responses further suggests that most students shared similar positive learning experiences during peer tutoring sessions.

Table 5. Level of Students' Engagement in Mathematics in Terms of Behavioral

Statement	Mean	SD	Remarks
As a student, I...			
...execute assigned mathematical tasks efficiently and punctually.	4.14	0.66	Agree
...seek clarification and pose questions to resolve misunderstandings in mathematical problems.	4.25	0.62	Strongly Agree
...maintain attention and concentration throughout peer tutoring activities.	4.46	0.58	Strongly Agree
...engage in mathematical activities to contribute to peer tutoring sessions.	4.47	0.58	Strongly Agree
...work with peers to solve mathematical exercises effectively.	4.51	0.65	Strongly Agree
Weighted Mean	4.37		
SD	0.62		
Verbal Interpretation	Very High		

Among the indicators, the statement "work with peers to solve mathematical exercises effectively" obtained the highest mean score of 4.51 (SD = 0.65), interpreted as Strongly Agree. This implies that students were highly engaged in cooperative problem-solving activities, demonstrating a willingness to collaborate with classmates to complete Mathematics tasks.

The indicator "engage in mathematical activities to contribute to peer tutoring sessions" recorded a mean of 4.47 (SD = 0.58), indicating Strongly Agree. This suggests that students were not passive learners but active contributors during peer tutoring. They willingly participated in classroom activities and took responsibility for their learning, reflecting a strong sense of involvement and accountability in the learning process.

Similarly, the statement "maintain attention and concentration throughout peer tutoring activities" had a mean of 4.46 (SD = 0.58), indicating Strongly Agree. This indicates that students were able to sustain focus during Mathematics sessions, suggesting that peer tutoring helped maintain their interest and reduced disengagement. Sustained attention is a key component of behavioral engagement, as it reflects students' ability to remain mentally and physically involved in learning tasks.

The indicator "seek clarification and pose questions to resolve misunderstandings in mathematical problems" had a mean of 4.25 (SD = 0.62), indicating Strongly Agree. This shows that students were comfortable asking questions and seeking help from peers during discussions. This behavior indicates a healthy learning environment where students feel safe to express confusion and clarify misunderstandings, which is essential in Mathematics learning.

Finally, the statement "execute assigned mathematical tasks efficiently and punctually" had the lowest mean of 4.14 (SD = 0.66), indicating agreement. Although this is slightly lower compared to other indicators, it still reflects a positive

level of responsibility and task completion among students. It suggests that while students are generally engaged, there is still room for improvement in consistency and time management when accomplishing assigned tasks.

Overall, the findings indicate that students demonstrated a very high level of behavioral engagement in Mathematics. This suggests that peer tutoring is effective in promoting active participation, collaboration, attentiveness, and responsibility among learners.

Table 6. Level of Students' Engagement in Mathematics in Terms of Emotional

Statement	Mean	SD	Remarks
As a student, I...			
...demonstrate positive engagement and interest during math sessions with peer tutoring.	4.35	0.63	Strongly Agree
...apply peer support to enhance confidence in solving mathematical problems..	4.49	0.58	Strongly Agree
...respond to peer assistance by sustaining motivation and active participation in learning.	4.39	0.62	Strongly Agree
...manage learning stress through peer tutoring support.	4.28	0.61	Strongly Agree
...evaluate personal achievement after completing tasks during peer tutoring sessions.	4.40	0.62	Strongly Agree
Weighted Mean	4.38		
SD	0.61		
Verbal Interpretation	Very High		

The results revealed in Table 6 are a very high level of students' engagement, motivation, and emotional support in mathematics learning through peer tutoring, as reflected in the weighted mean of 4.38 (SD = 0.61), interpreted as "Strongly Agree." This indicates that students consistently perceive peer tutoring as an effective strategy that enhances engagement, confidence, motivation, and stress management in mathematics learning.

The findings suggest that collaborative learning environments create meaningful academic and psychosocial benefits among learners.

The highest mean was observed for the indicator 'applying peer support to enhance confidence in solving mathematical problems' (M = 4.49, SD = 0.58). This emphasizes the strong influence of peer interaction in building students' mathematical self-efficacy.

Students also highly rated evaluating personal achievement after completing tasks during peer tutoring sessions (M = 4.40, SD = 0.62) and responding to peer assistance by sustaining motivation and active participation (M = 4.39, SD = 0.62). These findings indicate that peer tutoring promotes reflective learning and sustained engagement.

Furthermore, indicators of positive engagement and interest during math sessions (M = 4.35, SD = 0.63) and of managing learning stress through peer tutoring support (M = 4.28, SD = 0.61) suggest that peer tutoring also plays a vital role in reducing mathematics anxiety and promoting emotional well-being.

The relatively low standard deviation values (0.58–0.63) indicate strong consistency in student responses, suggesting that most learners share similar positive perceptions of peer

tutoring. This consistency reinforces the reliability of the findings and supports the conclusion that peer tutoring is widely accepted as an effective instructional strategy.

Overall, the findings affirm that peer tutoring is a highly effective instructional approach in mathematics education, significantly enhancing students' engagement, confidence, motivation, and stress management.

Table 7 presents the level of students' cognitive engagement in Mathematics. The data revealed a weighted mean of 4.36 and a standard deviation of 0.60, interpreted as Very High. This result indicates that the students demonstrated a very high level of mental involvement and active participation in learning Mathematics. The low standard deviation further implies that the respondents shared relatively consistent perceptions regarding their cognitive engagement during classroom activities.

Table 7. Level of Students' Engagement in Mathematics in Terms of Cognitive

Statement	Mean	SD	Remarks
As a student, I...			
...apply suggested problem-solving strategies to complete mathematical tasks.	4.42	0.60	Strongly Agree
...integrate new mathematical concepts with prior knowledge to construct understanding.	4.24	0.54	Strongly Agree
...analyze and interpret the logic behind mathematical problems to comprehend underlying principles.	4.24	0.59	Strongly Agree
...evaluate and revise solutions to address errors and improve understanding.	4.40	0.64	Strongly Agree
...engage collaboratively with challenging problems to enhance learning and motivation.	4.49	0.60	Strongly Agree
Weighted Mean	4.36		
SD	0.60		
Verbal Interpretation	Very High		

Among the indicators, the statement "engage collaboratively with challenging problems to enhance learning and motivation" had the highest mean score of 4.49 and a standard deviation of 0.60, indicating Strongly Agree. This suggests that students were highly engaged when working collaboratively with peers to solve difficult mathematical problems. The finding implies that peer interaction and collaborative activities helped learners become more motivated, confident, and mentally engaged in the learning process.

The statement "apply suggested problem-solving strategies to complete mathematical tasks" obtained a mean of 4.42 and a standard deviation of 0.60, also verbally interpreted as Strongly Agree. This indicates that students were capable of applying appropriate strategies and procedures when solving mathematical tasks. It further shows that the learners actively processed information and utilized guided techniques during classroom activities.

Similarly, the indicator "evaluate and revise solutions to address errors and improve understanding" recorded a mean of 4.40 and a standard deviation of 0.64, interpreted as Strongly Agree. This finding suggests that students demonstrated reflective thinking and were willing to review and improve their answers to better understand mathematical concepts. Such behavior reflects a high level of cognitive engagement

because learners become more aware of their mistakes and actively seek ways to correct them.

Meanwhile, the statements "integrate new mathematical concepts with prior knowledge to construct understanding" and "analyze and interpret the logic behind mathematical problems to comprehend underlying principles" both obtained a mean of 4.24, with standard deviations of 0.54 and 0.59, respectively, and were verbally interpreted as Strongly Agree. These results indicate that students were able to connect previous learning experiences with new mathematical concepts and apply analytical thinking in solving problems. This implies that learners developed a deeper understanding of mathematical principles through active engagement and peer-assisted learning activities.

Overall, the findings reveal that students exhibited a very high level of cognitive engagement in Mathematics. The results suggest that peer tutoring encouraged students to think critically, collaborate actively, and apply problem-solving strategies effectively during learning activities.

Table 8. Level of Students' Engagement in Mathematics in Terms of Social

Statement	Mean	SD	Remarks
As a student, I...			
...demonstrate openness in communicating with a peer tutor or tutee during learning activities.	4.31	0.62	Strongly Agree
...pose relevant questions to clarify understanding during peer tutoring sessions.	4.29	0.62	Strongly Agree
...engage in collaborative discussions during peer tutoring activities.	4.40	0.64	Strongly Agree
...articulate ideas during peer tutoring interactions.	4.32	0.58	Strongly Agree
...evaluate peer interactions as respectful and supportive during tutoring sessions.	4.64	0.51	Strongly Agree
Weighted Mean	4.39		
SD	0.59		
Verbal Interpretation	Very High		

Table 8 presents the level of students' social engagement in mathematics during peer tutoring activities. The results show that all indicators were rated as "Strongly Agree," indicating that students consistently demonstrate positive interaction, communication, and collaboration with their peers.

Among the indicators, the highest mean was observed for "evaluate peer interactions as respectful and supportive during tutoring sessions" ($M = 4.64$, $SD = 0.51$), suggesting that students perceive a strong sense of respect and support in peer tutoring environments. This is followed by "engage in collaborative discussions during peer tutoring activities" ($M = 4.40$, $SD = 0.64$), indicating active participation in group discourse. Additionally, "articulate ideas during peer tutoring interactions" ($M = 4.32$, $SD = 0.58$) and "demonstrate openness in communicating" ($M = 4.31$, $SD = 0.62$) reflect students' willingness to share thoughts and communicate effectively. Meanwhile, "pose relevant questions to clarify understanding" ($M = 4.29$, $SD = 0.62$) further highlights students' engagement in meaningful academic conversations. The overall weighted mean of 4.39 ($SD = 0.59$), interpreted as "Very High," indicates that students exhibit a strong level of social engagement in mathematics. The relatively low standard deviation suggests consistency in students' responses,

reflecting a shared positive perception of peer interactions during tutoring sessions.

In summary, the findings demonstrate that students are actively interacting, communicating, and collaborating with their peers during peer tutoring. This high level of social engagement highlights the effectiveness of peer tutoring in fostering positive relationships and a cooperative learning environment in mathematics.

Level of Students' Performance

In this study, it refers to the level of students' performance in mathematics learning through peer tutoring. It focuses on the extent to which students demonstrate mastery of mathematical concepts, problem-solving skills, accuracy, and overall academic achievement. The results are analyzed using the mean, standard deviation, and corresponding verbal interpretation to provide a clear and objective presentation of students' performance levels. Moreover, the discussion is supported by related literature to better explain how peer tutoring influences students' academic outcomes in mathematics.

Table 9 presents the level of students' mathematical performance in terms of the formative test, including the distribution of scores with their corresponding frequency, percentage, and descriptive remarks.

Table 9. Level of Students' Mathematics Skills in Terms of Problem-Solving Skills

Scores	Frequency	Percentage	Descriptive Equivalent
49-60	30	41.67%	Outstanding
37-48	27	37.50%	Very Satisfactory
25-36	15	20.83%	Satisfactory
13-24	0	0.00%	Fair
1-12	0	0.00%	Needs Improvement
Total	72	100.00%	

Weighted Mean = 45.21
SD=9.10

The result revealed that 41.67% of students achieved an outstanding rating on the exam with their scores in the 49 to 60 range (30 students). Additionally, 27 students received a Very Satisfactory rating (37-48 range) equating to 37.50% of all test takers, whereas the Satisfactory rating (25-36 range) represented 20.80% (15 students). There were no students rated as Fair or Needs Improvement.

A weighted mean of 45.21 with a standard deviation of 9.10 indicates students are performing at a Very Satisfactory level as measured by the formative assessment average; however, because of the standard deviation, there exists a moderate amount of variability in student scores. This reveals that while many students scored high on the exam, a substantial number scored much lower than others.

In summary, student performance on formative assessments indicates that students possess a competent level of mathematical knowledge and are primarily achieving Very Satisfactory to Outstanding levels of performance. The instructional strategies implemented during these formative assessments appear to be successful in aiding students' grasp of mathematical concepts. Continued support via differentiated instruction for individual learners will be

required to continue improving and equalizing student performance.

Test of Significant between Peer Tutoring as an Intervention Strategy and Students' Engagement in Mathematics

To test the significant relationship between Peer Tutoring as an Intervention Strategy and Students' Engagement in Mathematics in terms of behavioral, emotional, cognitive and social, was treated statistically using Jamovi 2.3.28 using the Pearson correlation coefficient.

Table 10. Peer Tutoring as an Intervention Strategy and Students' Engagement in Mathematics

Peer Tutoring as an Intervention Strategy (IV)	Students' Engagement in Mathematics (DV)			
	Behavioral	Emotional	Cognitive	Social
Learning: Pearson Correlation	0.27*	0.20	0.20	0.34**
Interaction Significance(2-Tailed)	0.022	0.091	0.096	0.004
N	72	72	72	72
Support: Pearson Correlation	0.24*	0.21	0.16	0.32**
Focus Significance(2-Tailed)	0.043	0.075	0.187	0.007
N	72	72	72	72
Structure: Pearson Correlation	0.22	0.13	0.10	0.33**
Guidance Significance(2-Tailed)	0.069	0.291	0.389	0.005
N	72	72	72	72
Social: Pearson Correlation	0.18	0.14	0.21	0.26*
Interaction Significance(2-Tailed)	0.131	0.257	0.076	0.030
N	72	72	72	72

Note: *p<.05, ** p<.01, ***p<.001

Table 10 presents the relationship between peer tutoring as an intervention strategy and students' engagement in mathematics in terms of behavioral, emotional, cognitive, and social dimensions using the Pearson correlation coefficient.

The results revealed that there is a significant positive relationship between peer-tutoring as learning interaction, and student behavioral engagement ($r = 0.27$, $p = 0.022$); however, the degree of correlation is weak. There is also an existing relationship between peer-tutoring as learning interaction, and student social engagement ($r = 0.34$, $p = 0.004$). The strength of this relationship is moderate. There is no statistically significant relationship found between peer-tutoring as learning interaction and student emotional ($r = 0.20$, $p = 0.091$) and cognitive ($r = 0.20$, $p = 0.096$) engagement. This implies that student participation with peers engaged in peer-tutoring will increase their student socialization but may not through the tutor aspect correlate their emotional and cognitive engagement.

Support focus moderate to strong relationship between peer-tutoring as support focus (assistance during peer tutoring) to encourage student behavioral engagement, ($r = 0.24$, $p = 0.043$), and social engagement ($r = 0.32$, $p = 0.007$); However, there are no statistically significant relationships for emotional ($r = 0.21$, $p = 0.075$) and cognitive engagement ($r = 0.16$, $p = 0.187$). Therefore, while providing assistance (support focus) during the peer-tutoring process may improve the student's socialization and participation, support provided does not have a significant relationship on the emotional and cognitive aspects of peer-tutoring.

When examining structured guidance only social engagement was found to have a statistically significant relationship with attendance ($r = 0.33$, $p = 0.005$). There are no statistically significant relationships for behavioral ($r =$

0.22, $p = 0.069$), emotional ($r = 0.13$, $p = 0.291$), or cognitive engagement ($r = 0.10$, $p = 0.389$) as they relate to structured guidance. Thus, structured guidance appears to enhance the student socially related to peer-tutoring but does not appear to enhance other engagement types.

Social Interaction is not significantly correlated to behavioral ($r = 0.18$, $p = 0.131$), emotional ($r = 0.14$, $p = 0.257$), or cognitive ($r = 0.21$, $p = 0.076$) engagement and relatively minorly to social engagement ($r = 0.26$, $p = 0.030$). Social interactions among peers may only create stronger engagement in social engagement with mathematics.

In summary, peer tutoring as an intervention strategy has a significant relationship to students' social engagement on all dimensions, whereas only some aspects have a significant relationship to behavioral engagement; and peer tutoring does not have significant relationships with emotional and cognitive engagement. Consequently, while peer tutoring may promote greater interaction, participation and collaboration among students, it is likely that other strategies should be implemented to improve students' emotional and cognitive processing of mathematics.

Consistent with the findings of the present study, previous research indicates that peer tutoring has a stronger influence on students' social engagement than on other dimensions of engagement. For instance, Ulvseth et al., (2025), found that peer tutoring significantly enhances students' interaction, collaboration, and participation in classroom activities. However, recent research indicates that while peer tutoring contributes to student engagement in mathematics, its effectiveness in enhancing emotional and cognitive engagement is strengthened when combined with structured instructional strategies and teacher facilitation (Topping, 2018; Fuchs et al., 2019).

Test of Significant Effect of Peer Tutoring as an intervention strategy on the Students' Performance in Mathematics

The significant effect of peer tutoring as an intervention strategy on the students' performance in mathematics in terms of summative test was treated statistically using Real Statistics Data Analysis Tools using multiple regression analysis.

A multiple regression analysis was conducted to determine whether peer tutoring as an intervention strategy, in terms of learning interaction, support focus, structure guidance, and social interaction, could significantly predict students' performance in mathematics in terms of the summative test.

Based on results from ANOVA, peer tutoring variables have produced a significant effect on students' performance in the summative test with a statistically significant result ($F(4, 67) = 4.04$, $p = 0.005$). As such, peer tutoring as an intervention strategy has produced significant effects on students' mathematics performance, overall.

None of the four predictors, analyzed separately, was found to be significantly predictive of final exam performance at the 0.05 level of significance. This means none of the predictor variables were statistically significant under the criteria of this analysis. Learning Interaction ($B = -0.02$, $t = -0.04$, $p = 0.964$, Support Focus ($B = -0.24$, $t = -0.69$, $p = 0.492$, Structures Guidance ($B = -0.28$, $t = -0.69$, $p = 0.490$,

Social Interaction ($B = -0.49$, $t = -1.26$, $p = 0.210$), therefore, these four variables do not significantly predict students' performance on summative assessments based upon the criteria of this analysis. Each of these predictor variables is part of a peer tutoring program and, therefore, may have contributed to the overall effect on students' summative exam achievement, although each of these predictors individually did not provide a contribution sufficient to significantly affect students' final scores.

Table 11. Regression Analysis on the Peer Tutoring as an intervention strategy on the Students' Performance in Mathematics

ANOVA^a

Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	8.15	4	2.04	4.04	0.005
Residual	33.73	67	0.50		
Total	41.88	71			

a. Dependent Variable: Summative Test

b. Predictors: Learning Interaction, Support Focus, Structure Guidance and Social Interaction

Coefficients^a

Model	Unstandardized Coefficients			
	B	Std. Error	T	Sig.
(Constant)	8.89	1.17	7.58	<.000
Learning Interaction	-0.02	0.41	-0.04	0.964
Support Focus	-0.24	0.34	-0.69	0.492
Structure Guidance	-0.28	0.40	-0.69	0.490
Social Interaction	-0.49	0.39	-1.26	0.210

In summary, peer tutoring has a significant effect on student mathematics performance based on overall peer tutoring performance when considering all four variables as a whole. However, considering the variables separately, therefore, leads to not significant predictions from the four variables on the students' performance. It can be concluded that the interaction between the predictor variables in peer tutoring leads to separate increases in students' performance rather than the independent contributions of each variable. Therefore, when implementing a peer tutoring program, schools may be more effective if they use the peer tutor model in its entirety rather than as individual components to increase students' mathematics achievement.

Consistent with the present study's findings, previous research supports the idea that peer tutoring is most effective when implemented as a comprehensive, integrated strategy rather than as isolated components. Moliner and Alegre (2020) found that the combined structure and interaction within peer tutoring significantly improved students' mathematics outcomes, emphasizing the importance of the whole approach. Similarly, Abdulkarim et al. (2022) reported that overall peer tutoring implementation led to meaningful gains in students' engagement and performance, rather than the effects of individual elements alone, highlighting that its effectiveness lies in the synergy of its components.

IV. CONCLUSION AND RECOMMENDATIONS

The results revealed that peer tutoring as an intervention strategy has a significant relationship to students' social

engagement on all dimensions, whereas only some aspects have a significant relationship to behavioral engagement; and peer tutoring does not have significant relationships with emotional and cognitive engagement. Consequently, while peer tutoring may promote greater interaction, participation and collaboration among students, it is likely that other strategies should be implemented to improve students' emotional and cognitive processing of mathematics.

In terms of academic performance, peer tutoring has a significant effect on student mathematics performance based on overall peer tutoring performance when considering all four variables as a whole. However, considering the variables separately, therefore, leads to not significant predictions from the four variables on the students' performance. It can be concluded that the interaction between the predictor variables in peer tutoring leads to separate increases in students' performance rather than the independent contributions of each variable. Therefore, when implementing a peer tutoring program, schools may be more effective if they use the peer tutor model in its entirety rather than as individual components to increase students' mathematics achievement.

Based on the findings and conclusions of the study on peer tutoring as an intervention strategy on students' engagement and performance in mathematics, the following recommendations are advanced:

School leaders may support the implementation of peer tutoring programs by providing training, resources, and time allocation for teachers. Encouraging collaborative teaching practices and fostering a school culture that values peer-assisted learning can strengthen the intervention's overall effectiveness.

Teachers are encouraged to implement peer tutoring as a regular instructional strategy in mathematics classes. To maximize its effectiveness, they should ensure that peer tutoring sessions are well-structured, with clear guidelines,

defined roles, and continuous monitoring. Additionally, teachers should integrate other strategies such as differentiated instruction, scaffolding, and reflective activities to further enhance students' emotional and cognitive engagement.

Students are encouraged to actively participate in peer tutoring activities by engaging in discussions, asking questions, and supporting their peers. Developing a sense of responsibility, cooperation, and respect during peer interactions can enhance both their learning experience and academic performance.

Future studies may explore other variables that could influence students' emotional and cognitive engagement, such as motivation, learning styles, and teaching approaches. Researchers may also consider using different research designs, larger sample sizes, or other subject areas to further validate and expand the findings of this study.

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