

Collaborative Learning Approach: Its Influence on Students' Behavior and Skills in Mathematics

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Abstract—This study examined the influence of the collaborative learning approach on the behavior and skills of Grade 8 students in mathematics at Memorial High School, Inc., in Luisiana, Laguna, during the 2025–2026 academic year. Specifically, it determined the level of the collaborative learning approach in terms of cognitive discussion, group work, and peer interaction; the level of students' behavior in mathematics in terms of persistence and perseverance, study habits, time management, self-regulation, and willingness to collaborate lastly the level of their mathematic skills i.e., problem solving, data analysis, and critical thinking; also the significant correlation between the collaborative learning approach and students' behavior in mathematics; and the significant effect of the collaborative learning approach on students' skills in mathematics. A descriptive research design using both correlational and cause-and-effect approaches was employed, involving 102 Grade 8 students selected through purposive sampling. Data were collected using a validated researcher-made survey questionnaire and a written test. Statistical tools, including weighted mean, standard deviation, Pearson correlation, and regression analysis, were used to analyze the data. The findings revealed that the Collaborative Learning Approach was very highly practiced in Mathematics classes. Students' behavior in terms of persistence, study habits, time management, self-regulation, and willingness to collaborate was also found to be high to very high. In addition, students demonstrated outstanding performance in problem-solving, data analysis, and critical thinking skills. The results further showed significant positive Mathematics. However, the Collaborative Learning Approach showed no statistically significant effect on students' Mathematics skills, although positive trends were observed. There is a significant relationship between the collaborative learning approach and students' behavior in Mathematics were identified in the development of learning behaviors among the students that leads to the rejection of the null hypothesis indicating that the teaching approach contributes positively to the learning process and creates opportunities for students to interact meaningfully with their peers, exchange ideas, and develop a deeper understanding of mathematical concepts. However, there is no significant effect found between the collaborative learning approach and students' mathematical skills, resulting in the acceptance of the null hypothesis. Despite this, only peer interaction shows an effective strategy for enhancing student engagement, participation, motivation, and positive learning behavior in Mathematics. It is recommended that teachers continue to implement collaborative learning strategies to foster positive learning behaviors and support student development and the students should be encouraged to actively participate in collaborative learning activities, share ideas with peers, and develop positive learning behaviors such as persistence, effective study habits, and self-regulation.

Keywords— Collaborative learning approach, student behavior, mathematical skills, descriptive-correlational research.

I. INTRODUCTION

Mathematics is often perceived as a daunting subject, evoking anxiety and frustration among students. The traditional approach to teaching mathematics, primarily relying on lectures and individualized instruction, may inadvertently reinforce these negative perceptions. However, educators have increasingly recognized the potential of collaborative learning approaches to transform the teaching and learning of mathematics.

Collaborative learning emphasizes active participation, interaction, and cooperation among students in solving problems, sharing ideas, and collectively constructing knowledge. Through collaborative learning, students not only enhance their understanding of mathematical concepts but also develop crucial collaborative skills such as communication, teamwork, and problem-solving. The influence of collaborative learning approaches on students' attitudes towards mathematics and their collaborative skills aims to deepen understanding of how collaborative learning can enhance the learning experience and outcomes in mathematics classrooms.

Wakhata et. al, (2024) stated that a student's success in mathematics is not determined solely by cognitive ability or the quality of instruction; it is significantly influenced by their attitude. Attitude toward mathematics is a multidimensional construct encompassing a student's emotions, beliefs, and behaviors toward the subject. When a student possesses a positive attitude characterized by confidence, curiosity, and a belief in the utility of mathematics, they are more likely to engage in "deep learning" and exhibit resilience when faced with complex equations.

Therefore, this study explores the influence of the collaborative learning approach on students' attitudes toward mathematics and their collaborative skills. By analyzing the outcomes of this approach in the mathematics classroom, the study aims to contribute valuable insights to ongoing efforts to improve math instruction and foster a more positive, interactive learning experience for students.

1.1 Statement of the Problem

Problem/s which were addressed by the research

This study aimed to determine the influence of the Collaborative Learning Approach on students' behavior and mathematical skills. Specifically, it sought to answer the following questions:

1. What is the level of Collaborative Learning Approach in terms of:
 - 1.1 Cognitive discussion
 - 1.2 Group work, and
 - 1.3 Peer interaction?
2. What is the level of students' behavior in Mathematics in terms of:
 - 2.1 Persistence and Perseverance
 - 2.2 Study Habits
 - 2.3 Time Management
 - 2.4 Self-Regulator, and
 - 2.5 Willingness to Collaborate?
3. What is the level of students' skills in Mathematics:
 - 3.1 Problem Solving
 - 3.2 Data Analysis, and
 - 3.3 Critical Thinking?
4. Does the Collaborative Learning Approach significantly correlate with the students' behavior in Mathematics?
5. Does the Collaborative Learning Approach significantly affect the students' skills in Mathematics?

II. METHODOLOGY

A descriptive research design using both correlational and cause-and-effect approaches was employed, involving 102 Grade 8 students selected through purposive sampling. Data were collected using a validated researcher-made survey questionnaire and a written test. Statistical tools, including weighted mean, standard deviation, Pearson correlation, and regression analysis, were used to analyze the data.

III. RESULTS AND DISCUSSION

This part covers the presentation, analysis, and interpretation of data collected to address the sub-problem related to the main problem of this study. This section discusses the findings based on the questions.

Level of the Collaborative Learning Approach in Mathematics

In this study, the level of the Collaborative Learning Approach in Mathematics refers to Cognitive Discussion, Group Work, and Peer Interaction.

The following table reveals the statement, mean, standard deviation, remarks, and verbal interpretation of the Collaborative Learning Approach.

Among the indicators, the statement "provides us enough time to process and discuss complex problems before moving to the next topic" obtained the highest mean ($M = 4.40$, $SD = 0.69$), suggesting that learners are given adequate opportunities to analyze and discuss mathematical concepts collaboratively. This practice is essential because allowing students time for discussion and reflection enables them to clarify misconceptions and construct knowledge through peer interaction. Similarly, the item "motivates us to share and examine different strategies for solving the same math problem" also received a high rating ($M = 4.33$, $SD = 0.67$), indicating that students are encouraged to explore multiple problem-solving approaches, which strengthens analytical thinking and cooperative learning.

Table 1 shows the level of Collaborative Learning Approach in Mathematics in terms of Cognitive Discussion as perceived by the respondents, in terms of Cognitive Discussion.

Table 1. Level of the Collaborative Learning Approach in Mathematics in terms of Cognitive Discussion

Statement	Mean	SD	Remarks
My teacher...			
...encourages us to use specific mathematical terms (e.g., variables, theorems, functions) when talking with peers.	4.21	0.65	Strongly Agree
...guides us to properly use mathematical vocabulary when explaining our ideas to classmates.	4.14	0.79	Agree
...provides us enough time to process and discuss complex problems before moving to the next topic.	4.4	0.69	Agree
...motivates us to share and examine different strategies for solving the same math problem.	4.33	0.67	Strongly Agree
...prompts us to "why" and "how" questions can lead to deeper discussions within the groups.	4.28	0.73	Strongly Agree
Weighted Mean	4.27		
SD	0.67		
Verbal Interpretation	Very High		

The results revealed a weighted mean of 4.27 ($SD = 0.67$), which is verbally interpreted as Very High. It indicates that collaborative learning practices that promote cognitive discussion are highly evident in the mathematics classroom.

In summary, the very high level of cognitive discussion observed in this study suggests that the Collaborative Learning Approach effectively facilitates active engagement, meaningful dialogue, and deeper mathematical understanding among Grade 8 students.

Table 2. Level of the Collaborative Learning Approach in Mathematics in terms of Group Work

Statement	Mean	SD	Remarks
My teacher...			
...provides a clear guidelines and goals before the start any group activity.	4.44	0.79	Strongly Agree
...organizes groups where every member has a specific role or responsibility.	4.35	0.6	Strongly Agree
...arranges classroom layout and provide learning resources to make group collaboration easy and effective."	4.35	0.71	Strongly Agree
...designs group tasks that must work together to find the solution.	4.25	0.77	Strongly Agree
...moves around the room to facilitate and guide groups instead of just lecturing at the board.	4.38	0.8	Strongly Agree
Weighted Mean	4.35		
SD	0.68		
Verbal Interpretation	Very High		

Table 2 shows the extent of collaborative learning in mathematics through group work. The weighted mean of 4.35 with a standard deviation of 0.68 is verbally interpreted as Strongly Agree. This indicates that their teacher effectively implements collaborative learning strategies during group activities. The statement "provides clear guidelines and goals before the start of any group activity" had the highest mean of 4.44 and a standard deviation of 0.79, indicating Strongly Agree. Similarly, the statement "moves around the room to

facilitate and guide groups instead of just lecturing at the board” received a mean of 4.38 and a standard deviation of 0.80, indicating Strongly Agree.

Moreover, the statements “organizes groups where every member has a specific role or responsibility” and “arranges classroom layout and provides learning resources to make group collaboration easy and effective” both obtained a mean of 4.35, with standard deviations of 0.60 and 0.71, respectively. Meanwhile, the statement “designs group tasks that require students to work together to find the solution” received a mean of 4.25 and a standard deviation of 0.77, interpreted as Strongly Agree.

In summary, it indicates that collaborative learning strategies are highly practiced in the classroom and positively influence students' participation during group work in mathematics. This suggests that when teachers provide clear instructions, structured roles, and active facilitation, students become more engaged and cooperative in solving mathematical tasks.

Table 3 shows the extent of the Collaborative Learning Approach: Its Influence on the Students' Behavior in Mathematics in terms of Peer Interaction.

Table 3 also shows the extent of the Collaborative Learning Approach in Mathematics, which refers to Peer Interaction, attained WM = 4.36 (SD=0.69) and verbally interpreted as Very High among the respondents. The results reveal that students strongly agree that their teacher promotes a positive environment that encourages interaction, communication, and cooperation among classmates during mathematics activities.

The statement “encourages us to listen and respect each other's ideas, even if they are different from our own” had the highest mean of 4.49 and a standard deviation of 0.73, indicating Strongly Agree.

Table 3. Extent of the Collaborative Learning Approach in Mathematics in terms of Peer Interaction

Statement	Mean	SD	Remarks
This section measures the quality of support and exchange between students as facilitated by the teacher, My teacher...			
...creates a classroom atmosphere where I feel comfortable asking my classmates for help.	4.45	0.67	Strongly Agree
...values our contributions during collaborative tasks given to us.	4.11	0.78	Strongly Agree
...encourages us to listen and respect each other's ideas, even if they are different from our own.”	4.49	0.73	Strongly Agree
...facilitates us to communicate effectively and politely with our peers during group work.	4.38	0.68	Strongly Agree
...promotes peer tutoring and feedback consistently during mathematics lessons.	4.35	0.71	Strongly Agree
Weighted Mean	4.36		
SD	0.69		
Verbal Interpretation	Very High		

Similarly, the statement “creates a classroom atmosphere where I feel comfortable asking my classmates for help” obtained a mean of 4.45 (SD = 0.67), also interpreted as Strongly Agree. This suggests that students feel safe and confident seeking assistance from their classmates, which

strengthens collaboration and mutual support during learning activities.

The statement “facilitates us to communicate effectively and politely with our peers during group work” received a mean of 4.38 (SD = 0.68), indicating that the teacher encourages proper communication and respectful interaction among students during group work.

Furthermore, the statement “promotes peer tutoring and feedback consistently during mathematics lessons” received a mean of 4.35 (SD = 0.71), indicating Strongly Agree. This implies that students are given opportunities to support one another in understanding mathematical concepts through peer feedback.

Meanwhile, the statement “values our contributions during collaborative tasks given to us” received the lowest mean of 4.11 (SD = 0.78), though it is still interpreted as Strongly Agree. This indicates that students still perceive that their ideas and contributions are recognized during collaborative learning activities.

Overall, the weighted mean of 4.36 and a standard deviation of 0.69 is verbally interpreted as Very High. This indicates that the collaborative learning approach strongly promotes peer interaction among students in mathematics classes. It shows that students actively communicate, respect each other's ideas, and support one another in solving mathematical problems.

Level of Collaborative Learning Approach: Its Influence on the Students' Behavior in Mathematics

In this study, the level of the collaborative learning approach and its influence on the students' behavior in mathematics refers to persistence and perseverance, study habits, time management, self-regulator and willingness to collaborate.

The level of the collaborative learning approach: its influence on the students' behavior in mathematics is revealed in the following table, which shows the statement, meaning, standard deviation, remarks, and verbal interpretation.

Table 4 shows the Students' Behavior in Mathematics in terms of Persistence and Perseverance.

Table 4. Level of Students' Behavior in Mathematics in terms of Persistence and Perseverance.

Statement	Mean	SD	Remarks
As a student...			
...I creates a classroom atmosphere where I feel comfortable asking my classmates for help.	4.34	0.67	Strongly Agree
...I continue to work on a difficult math problem even when I don't find the answer right away.	4.14	0.78	Agree
...I persist in solving math problems even when they are complex and complicated.	4.04	0.79	Agree
...I analyze my mistakes and use them as a learning opportunity instead of giving up when I get an incorrect answer.	4.18	0.74	Agree
...I explore different strategies and approaches when solving challenging mathematics problems.	4.28	0.73	Strongly Agree
Weighted Mean	4.19		
SD	0.70		
Verbal Interpretation	High		

Table 4 presents the level to which the collaborative learning approach influences students' persistence and perseverance when facing challenging mathematics tasks. The results indicate that students generally demonstrate high levels of grit and determination during problem-solving activities.

The statement "creates a classroom atmosphere where I feel comfort. This shows that students feel supported in the classroom and are confident to seek assistance from peers when tackling difficult problems, which encourages

The statements "I explore different strategies and approaches when solving challenging mathematics problems" and "I analyze my mistakes and use them as a learning opportunity instead of giving up when I get an incorrect answer" obtained means of 4.28 (SD = 0.73) and 4.18 (SD = 0.74), respectively, both interpreted as Strongly Agree and Agree. These results suggest that students are willing to try alternative methods and learn from errors rather than giving up, reflecting resilience and perseverance in learning mathematics.

Meanwhile, statements such as "I continue to work on a difficult math problem even when I don't find the answer right away" and "I persist in solving math problems even when they are complex and complicated" obtained means of 4.14 (SD = 0.78) and 4.04 (SD = 0.79), interpreted as Agree. This indicates that although students generally persevere, some may occasionally feel challenged by more complex problems but still continue to engage in problem-solving.

Overall, the weighted mean of 4.19 with a standard deviation of 0.70 is verbally interpreted as High. This implies that the collaborative learning approach positively influences students' persistence and perseverance, helping them to remain determined, explore multiple strategies, and learn from mistakes when solving mathematical tasks.

Table 5 shows the level of Students' Behavior in Mathematics in terms of Study Habits.

Table 5. Level of Collaborative Learning Approach: It's Influence on the Students' Behavior in Mathematics in terms of Study Habits.

Statement	Mean	SD	Remarks
As a student...			
...I review old lessons before moving to a new topic.	4.1	0.76	Strongly Agree
...I organize math notes and worksheets to prepare for exams.	4.16	0.75	Agree
...I regularly practice math problems at home to reinforce what I learned in class	3.86	0.92	Agree
...I complete math assignments on time without reminders.	4.09	0.81	Agree
...I prioritize math homework over leisure time.	4.11	0.86	Strongly Agree
Weighted Mean	4.07		
SD	0.78		
Verbal Interpretation	High		

Table 5 presents the extent to which the collaborative learning approach influences students' study habits in mathematics, particularly in terms of organization, consistency, and prioritization of learning tasks. The results indicate that students generally exhibit strong study habits, demonstrating responsibility and dedication to mathematics learning.

The statement "I organize math notes and worksheets to prepare for exams" received a mean of 4.16 (SD = 0.75), indicating agreement and suggesting that students actively maintain an organized approach to studying, which aids their preparation for assessments. Similarly, "I review old lessons before moving to a new topic" and "I prioritize math homework over leisure time" obtained means of 4.10 (SD = 0.76) and 4.11 (SD = 0.86), interpreted as Strongly Agree, indicating that students recognize the importance of reviewing previous lessons and managing their time effectively to reinforce learning.

The statement "I complete math assignments on time without reminders" had a mean of 4.09 (SD = 0.81), indicating agreement, suggesting that students demonstrate responsibility and self-discipline in completing tasks. Meanwhile, "I regularly practice math problems at home to reinforce what I learned in class" received the lowest mean of 3.86 (SD = 0.92), interpreted as Agree, indicating that although students generally engage in independent practice, some may not consistently review or practice outside the classroom.

Overall, the weighted mean of 4.07 with a standard deviation of 0.78 is verbally interpreted as High, suggesting that the collaborative learning approach has a positive influence on students' study habits. The findings imply that collaborative strategies encourage students to be organized, consistent, and responsible in their approach to mathematics learning.

These results support the Collaborative Learning Theory of Johnson and Johnson, which highlights that structured group activities and peer collaboration can motivate students to develop better study habits and learning routines. Additionally, the findings align with Vygotsky's Social Constructivist Theory, which emphasizes that learning is enhanced through social interaction, guidance, and shared responsibility. When students participate in collaborative tasks, they are more likely to adopt habits that support independent learning and effective study practices.

Table 6 shows the level of Students' Behavior in Mathematics in terms of Time Management. The data indicate that students generally demonstrate a strong ability to organize and allocate time for learning mathematics, showing responsibility and focus in managing their academic tasks.

Table 6 presents the extent to which the collaborative learning approach influences students' time management in mathematics.

The statement "I efficiently manage time when studying mathematics" had the highest mean of 4.96 (SD = 0.88), indicating Strongly Agree and suggesting that students are confident in planning and using their study time effectively, reflecting strong time management skills. Similarly, "I focus on completing mathematics tasks before attending to other school assignments" received a mean of 4.39 (SD = 0.72), also interpreted as Strongly Agree, indicating that students prioritize mathematics learning and complete tasks in a timely manner. Other statements, including "I practice solving mathematics problems regularly", "I allot sufficient study time to challenging math topics", and "I don't delay my studies when it comes to math" obtained means of 4.05 (SD = 0.81),

3.94 (SD = 0.88), and 3.88 (SD = 0.96) respectively, all interpreted as Agree. This suggests that while students generally manage their study time well, there are areas where consistency could be improved, such as allocating more time to difficult topics or avoiding procrastination, interpreted as High, indicating that the collaborative learning approach positively influences students' time management in mathematics learning. The findings imply that when students engage in structured group activities and collaborative tasks, they are better able to plan, prioritize, and allocate sufficient time to complete mathematical exercises and assignments.

Table 6. Level of Students' Behavior in Mathematics in terms of Time Management.

Statement As a student...	Mean	SD	Remarks
...I practice solving mathematics problems regularly.	4.05	0.81	Agree
...I efficiently manage time when studying mathematics.	4.96	0.88	Strongly Agree
...I allot sufficient study time to challenging math topics.	3.94	0.88	Agree
...I don't delay my studies when it comes to math.	3.88	0.96	Agree
...I focus on completing mathematics tasks before attending to other school assignments.	4.39	0.72	Strongly Agree
Weighted Mean	4.04		
SD	0.81		
Verbal Interpretation	High		

Table 7 shows the level of Students' Behavior in Mathematics in terms of Self-Regulator.

Table 7 presents the extent to which the collaborative learning approach influences students' self-regulation in mathematics, particularly in their ability to monitor, control, and evaluate their own learning progress. The results indicate that students demonstrate a very high level of self-regulated learning behaviors when engaging in mathematics activities.

The statement "I check my answers to make sure they are correct before submitting" obtained the highest mean of 4.40 (SD = 0.65), interpreted as Strongly Agree. This result suggests that students practice careful review of their work, reflecting responsibility and awareness of the importance of accuracy in solving mathematical problems.

Table 7. Level of Students' Behavior in Mathematics in terms of Self-Regulator.

Statement As a student...	Mean	SD	Remarks
...I assess which math topics I need to work on.	4.11	0.66	Agree
...I take the initiative to look for resources (books, videos, or help), if I don't understand the concept.	4.18	0.71	Agree
...I reflect on my test results to understand how I can perform better next time.	4.18	0.74	Agree
...I check my answer to make sure it's correct before submitting.	4.4	0.65	Strongly Agree
...I set specific goals for what I want to achieve in every math lesson.	4.15	0.76	Agree
Weighted Mean	4.20		
SD	0.67		
Verbal Interpretation	Very High		

Similarly, the statements "I take the initiative to look for resources (books, videos, or help) if I don't understand the concept" and "I reflect on my test results to understand how I can perform better next time" both obtained a mean of 4.18 with standard deviations of 0.71 and 0.74, respectively, interpreted as Agree. These findings indicate that students actively seek ways to improve their understanding and evaluate their performance to enhance future learning. Furthermore, the statement "I set specific goals for what I want to achieve in every math lesson" received a mean of 4.15 (SD = 0.76), indicating agreement, suggesting that students demonstrate goal-setting behaviors that guide their learning. Meanwhile, "I assess which math topics I need to work on" had a mean of 4.11 (SD = 0.66), also interpreted as Agree, indicating that students can identify areas where they need improvement.

Overall, the weighted mean of 4.20 with a standard deviation of 0.67 is verbally interpreted as Very High, indicating that the collaborative learning mathematics. This implies that students are capable of monitoring their progress, reflecting on their performance, and taking responsibility for improving their mathematical understanding.

These findings suggest that collaborative learning environments encourage students to become more independent and reflective learners. When students interact with peers, discuss ideas, and collectively evaluate their work, they develop stronger self-regulation skills that help them manage their learning more effectively.

Table 8 shows the level of students' behavior in mathematics in terms of willingness to collaborate. This includes students' openness, motivation, and attitude toward working with their peers during learning activities. The results reveal that students demonstrate a very high level of willingness to collaborate in mathematics classes.

Table 8 presents the extent to which the collaborative learning approach influences students' willingness to collaborate in mathematics.

Table 8. Level of Collaborative Learning Approach: Its Influence on the Students' Behavior in Mathematics in terms of Willingness to Collaborate.

Statement As a student...	Mean	SD	Remarks
...I consider my classmates' suggestions to strengthen my understanding and confidence.	4.32	0.71	Strongly Agree
...I feel more motivated to participate in class when I work as part of a collaborative team.	4.33	0.74	Strongly Agree
...I actively explain math concepts to my peers to help them understand better.	4.06	0.83	Agree
...I prefer collaborating with classmates to solve complex math problems rather than working alone.	4.3	0.74	Strongly Agree
...I value my classmates' feedback to improve my mathematical skills.	4.41	0.71	Strongly Agree
Weighted Mean	4.29		
SD	0.71		
Verbal Interpretation	Very High		

The statement "I value my classmates' feedback to improve my mathematical skills" obtained the highest mean of 4.41 (SD = 0.71), interpreted as Strongly Agree. This indicates that students recognize the importance of peer feedback in

enhancing their understanding and improving their performance in mathematics.

Similarly, the statements “I feel more motivated to participate in class when I work as part of a collaborative team” and “I consider my classmates’ suggestions to strengthen my understanding and confidence” obtained means of 4.33 (SD = 0.74) and 4.32 (SD = 0.71), respectively, both interpreted as Strongly Agree. These findings suggest that collaborative learning increases students’ motivation and confidence as they engage in discussions and exchange ideas with their peers.

The statement “I prefer collaborating with classmates to solve complex math problems rather than working alone” received a mean of 4.30 (SD = 0.74), also interpreted as Strongly Agree, indicating that students generally prefer teamwork when dealing with challenging mathematical tasks. Meanwhile, the statement “I actively explain math concepts to my peers to help them understand better” had the lowest mean of 4.06 (SD = 0.83), indicating agreement. Although this is the lowest among the items, it still suggests that students are willing to assist their classmates and share their knowledge during group activities.

Overall, the weighted mean of 4.29 with a standard deviation of 0.71 is interpreted as Very High, indicating that the collaborative learning approach strongly encourages students to work with their peers in mathematics. The results imply that students are open to exchanging ideas, giving and receiving feedback, and supporting one another in solving mathematical problems.

Level of the Collaborative Learning Approach: Its Influence on the Students’ Skills in Mathematics

In this study, the level of Students’ Skills in Mathematics refers to Problem Solving, Data Analysis, and Critical Thinking, was measured by a written test.

The level of Students’ Skills in Mathematics revealed in the following table shows the raw score, frequency, percentage, mean, standard deviation, and verbal interpretation.

Table 9 shows the level of Students’ Skills in Mathematics in terms of Problem Solving

Table 9. Level of Students’ Skills in Mathematics in terms of Problem Solving.

Raw Score	Frequency (f)	Percentage (%)	Descriptive Equivalent
17-20	54	67.5	Outstanding
13-16	22	27.5	Very Satisfactory
9-12	2	2.50	Satisfactory
5 -8	1	1.25	Fair
1-4	1	1.25	Needs Improvement
	80	100	Outstanding

Mean=17.38 SD=3.09 VI=O

Table 9 presents students’ levels of skill in Mathematics, as measured by Problem Solving, based on the written test results. The data show that the majority of students obtained scores in the 17–20 range, with 54 students (67.5%), indicating an Outstanding result. This indicates that most of

the students demonstrated a very high level of competence in solving mathematical problems.

Meanwhile, 22 students or 27.5% achieved scores ranging from 13–16, which falls under the Very Satisfactory level. This suggests that many students performed well and demonstrated strong problem-solving abilities. On the other hand, only 2 students (2.5%) obtained Satisfactory scores, while 1 student (1.25%) was categorized as Fair, and another 1 student (1.25%) was categorized as Needs Improvement. These results indicate that only a very small proportion of students experienced difficulty in solving mathematical problems.

Furthermore, the findings reveal that students possess strong problem-solving skills in Mathematics, suggesting that the collaborative learning solve mathematical problems through interaction, discussion, and shared strategies with peers.

Overall, the computed mean score of 17.38 with a standard deviation of 3.09 is verbally interpreted as Outstanding. This implies that, on average, the students demonstrated a very high level of problem-solving skills in Mathematics. The relatively moderate standard deviation indicates that most students’ scores are clustered around the mean, suggesting consistent performance.

Table 10 shows the level of Students’ Skills in Mathematics in terms of Data Analysis.

Table 10. Level of Students’ Skills in Mathematics in terms of Data Analysis.

Raw Score	Frequency (f)	Percentage (%)	Descriptive Equivalent
17-20	55	68.75	Outstanding
13-16	17	21.25	Very Satisfactory
9-12	5	6.25	Satisfactory
5 -8	1	1.25	Fair
1-4	2	2.50	Needs Improvement
	80	100	Outstanding

Mean=17.26 SD=3.88 VI=O

Table 10 presents students’ levels of skill in Mathematics in Data Analysis, based on the written test results. The data reveal that the majority of students obtained scores in the 17–20 range, with 55 students (68.75%), which is interpreted as Outstanding. This indicates that most of the students demonstrated a very high level of ability in analyzing and interpreting mathematical data.

Additionally, 17 students, or 21.25%, achieved scores in the 13–16 range, corresponding to the Very Satisfactory level. This suggests that many students also performed well on data analysis tasks. Meanwhile, 5 students or 6.25% obtained Satisfactory scores, indicating an acceptable level of understanding of data analysis concepts.

On the other hand, only 1 student (1.25%) was classified as Fair, and 2 students (2.50%) were classified as Needs Improvement, indicating that only a small proportion of students experienced difficulty analyzing mathematical data.

Furthermore, the results suggest that students possess excellent data analysis skills, indicating that the collaborative learning approach helps them enhance their ability to interpret, organize, and analyze mathematical information through

group discussions, shared reasoning, and collaborative problem-solving activities.

Overall, the computed mean score of 17.26 with a standard deviation of 3.88 is verbally interpreted as Outstanding. This means that, on average, the students demonstrated a very high level of data analysis skills in Mathematics. The standard deviation indicates that although most students performed highly, there is some variation in their scores.

Table 11 shows the Level of Students' Skills in Mathematics in terms of Critical Thinking

Table 11 presents the level of students' skills in Mathematics in terms of Critical Thinking based on the results of the written test. The table shows that the majority of the students obtained scores within the 17–20 range, with 59 students or 73.75%, which is verbally interpreted as Outstanding. This indicates that most of the students demonstrated a very high level of critical thinking skills when solving mathematical problems and analyzing situations that require logical reasoning.

Table 11. Level of Students' Skills in Mathematics in terms of Critical Thinking

Raw Score	Frequency (f)	Percentage (%)	Descriptive Equivalent
17-20	59	73.75	Outstanding
13-16	14	17.5	Very Satisfactory
9-12	4	5	Satisfactory
5 -8	2	2.50	Fair
1-4	1	1.25	Needs Improvement
	80	100	Outstanding

Mean= 17.95 SD=3.60 VI=0

Furthermore, 14 students or 17.5% achieved scores ranging from 13–16, which falls under the Very Satisfactory level. This suggests that a significant number of students also showed strong abilities in evaluating information, making logical conclusions, and applying mathematical reasoning.

Meanwhile, 4 students or 5% obtained Satisfactory scores, indicating an acceptable level of critical thinking skills. On the other hand, 2 students (2.50%) were categorized as Fair, and 1 student (1.25%) was categorized as Needs Improvement, indicating that only a few students encountered difficulty with tasks that require deeper analysis and reasoning.

Moreover, the findings indicate that students possess excellent critical thinking skills in Mathematics, which may suggest that the collaborative learning approach effectively enhances students' ability to analyze problems, evaluate different solutions, and make logical decisions through interaction and discussion with their peers.

Overall, the computed mean score of 17.95 with a standard deviation of 3.60 is verbally interpreted as Outstanding. This implies that, on average, students demonstrated a very high level of critical thinking skills in Mathematics. The standard deviation suggests that while most students performed at a high level, there is still some variation in their scores.

Significant Relationship between Collaborative Learning Approach and the Students' Behavior in Mathematics

In this study, the level of the Collaborative Learning Approach refers to Cognitive discussion, Group work, and

Peer interaction, while the Students' Behavior in Mathematics refers to Persistence and Perseverance, Study Habits, Time Management, Self-Regulation, and Willingness to Collaborate.

The Significant Relationship between the Collaborative Learning Approach and the Students' Behavior in Mathematics is revealed in the following table, which shows the Multiple Regression Analysis using Pearson Product-Moment Correlation Coefficient or Pearson-r, p-value, and number of observations or respondents.

Table 12 presents the significant relationships between the Collaborative Learning Approach and Students' Behavior in Mathematics, including persistence and perseverance, study habits, time management, self-regulation, and willingness to collaborate.

The results show that Cognitive Discussion has a positive and significant relationship with all aspects of students' behavior. Specifically, it has a moderate positive correlation with persistence and perseverance ($r = 0.380$, $p = 0.001$), study habits ($r = 0.356$, $p = 0.001$), time management ($r = 0.332$, $p = 0.003$), and self-regulation ($r = 0.431$, $p = 0.000$). It also shows a significant relationship with willingness to collaborate ($r = 0.262$, $p = 0.019$). Since all p-values are less than 0.05, the relationships are considered statistically significant. This indicates that engaging students in cognitive discussions helps improve their positive learning behaviors in mathematics.

Table 12 shows the Significant Relationship between Collaborative Learning Approach and the Students' Behavior in Mathematics.

Table 12. Significant Relationship between Collaborative Learning Approach and the Students' Behavior in Mathematics Student's Behavior in Mathematics

Collaborative Learning Approach		Persistence and Perseverance	Study Habits	Time Management	Self-Regulation	Willingness to Collaborate
Cognitive Discussion	Pearson Correlation	0.380*	0.356*	0.332*	0.431*	0.262*
	Sig. (2-tailed)	0.001	0.001	0.003	0.000	0.019
	N	80	80	80	80	80
Group Work	Pearson Correlation	0.518*	0.381*	0.389*	0.490*	0.429*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
	N	80	80	80	80	80
Peer Interaction	Pearson Correlation	0.667*	0.309*	0.347*	0.465*	0.450*
	Sig. (2-tailed)	0.000	0.005	0.002	0.000	0.000
	N	80	80	80	80	80

Similarly, Group Work also demonstrates a significant positive relationship with all behavioral variables. The strongest correlation is observed in persistence and perseverance ($r = 0.518$, $p = 0.000$), followed by self-regulation ($r = 0.490$, $p = 0.000$) and willingness to collaborate ($r = 0.429$, $p = 0.000$). Moderate correlations are also observed with study habits ($r = 0.381$, $p = 0.000$) and time management ($r = 0.389$, $p = 0.000$). These findings suggest that structured

group work encourages students to develop responsible learning behaviors and enhances their engagement in mathematics activities.

Moreover, Peer Interaction shows the strongest relationship with persistence and perseverance ($r = 0.667$, $p = 0.000$), indicating a strong positive association. It also has significant correlations with study habits ($r = 0.309$, $p = 0.005$), time management ($r = 0.347$, $p = 0.002$), self-regulation ($r = 0.465$, $p = 0.000$), and willingness to collaborate ($r = 0.450$, $p = 0.000$). These results imply that frequent peer interaction in collaborative learning helps students develop stronger behavioral skills such as persistence, cooperation, and self-management.

Overall, the findings reveal that the Collaborative Learning Approach is significantly related to the students' behavior in Mathematics. Since all computed p-values are less than the 0.05 level of significance, the null hypothesis is rejected. This means that collaborative learning strategies such as cognitive discussions, group work, and peer interaction significantly influence the development of positive learning behaviors among students in mathematics.

Significant Effect of the Collaborative Learning Approach on the Students' Behavior in Mathematics

In this study, the level of the Collaborative Learning Approach refers to Cognitive discussion, Group work, and Peer interaction, while the Students' Skills in Mathematics refer to Problem Solving, Data Analysis, and Critical Thinking.

The Significant Effect of the Collaborative Learning Approach on Students' Skills in Mathematics is revealed in the following table, which presents the Multiple Regression Analysis using t-Test, including the computed t-value (t-cal), p-value, number of observations or respondents, and the critical t-value (t-crit) or constant.

Approach on the Students' Skills in Mathematics.

Table 13. Significant Effect between Collaborative Learning Approach on the Students' Behavior in Mathematics

		Students' Skills in Mathematics		
Collaborative Learning Approach		Problem Solving	Data Analysis	Critical Thinking
Cognitive Discussion	t-value	1.411	0.268	0.896
	Sig. (2-tailed)	0.162	0.789	0.373
	N	80	80	80
Group Work	t-value	1.376	0.616	0.328
	Sig. (2-tailed)	0.173	0.539	0.744
	N	80	80	80
Peer Interaction	t-value	1.964	-0.263	0.175
	Sig. (2-tailed)	0.053	0.793	0.861
	N	80	80	80

Constant=1.66

Table 14 presents the significant effect of the collaborative learning approach, specifically cognitive discussion, group work, and peer interaction on students' skills in mathematics in terms of problem solving, data analysis, and critical thinking. The analysis used the t-value and Sig. (2-tailed) to

determine whether the collaborative learning approaches significantly affect students' mathematical skills.

For cognitive discussion, the results show t-values of 1.411 for problem-solving, 0.268 for data analysis, and 0.896 for critical thinking, with corresponding significance values of 0.162, 0.789, and 0.373. Since all p-values are greater than 0.05, the results indicate that cognitive discussion does not have a statistically significant effect on students' mathematics skills in these areas.

Similarly, group work yielded t-values of 1.376 for problem-solving, 0.616 for data analysis, and 0.328 for critical thinking, with p-values of 0.173, 0.539, and 0.744, respectively. These p-values are also greater than 0.05, indicating that group work does not significantly influence students' problem-solving, data analysis, and critical thinking skills in mathematics.

For peer interaction, the t-values are 1.964 for problem solving, -0.263 for data analysis, and 0.175 for critical thinking, with corresponding significance values of 0.053, 0.793, and 0.861. Although this result is slightly above the conventional alpha level, it indicates a trend suggesting that peer interaction may positively influence problem-solving skills. With a larger sample, this effect could reach statistical significance.

While the statistical results did not reach the traditional threshold of significance ($p \leq 0.05$), the trends observed, especially in peer interaction, suggest that collaborative learning approaches may positively impact students' mathematical skills. The baseline level (constant = 1.66) shows that students already have measurable skills, and collaborative activities appear to enhance them. Therefore, the results are educationally meaningful and indicate areas for further investigation.

IV. CONCLUSION AND RECOMMENDATIONS

There is a significant relationship between the collaborative learning approach and students' behavior in mathematics that leads to the rejection of the null hypothesis. Therefore, this concludes that the Teaching Approach significantly contributes to the learning process and to the development of positive learning behaviors among students.

Meanwhile, there is no significant effect between the collaborative learning approach and students' skills in mathematics in which the null hypotheses were accepted. This concludes that the variations of Teaching Approach did not significantly influence the measured aspect of mathematical skills among the students.

However, only the peer interaction approach shows an effective strategy for improving students' engagement and learning behavior in mathematics. Even though the statistical effect on skills was not significant, collaborative learning still promotes meaningful interaction, motivation, and student participation.

Based on the findings and conclusions of the study, the following recommendations are offered:

Mathematics teachers should continue to implement collaborative learning strategies such as cognitive discussion,

group work, and peer interaction to encourage active participation and meaningful learning among students.

Teachers are encouraged to design more structured collaborative activities that focus on improving students' higher-order thinking skills, particularly in problem solving, data analysis, and critical thinking.

Students 'should be encouraged to actively participate in collaborative learning activities, share ideas with peers, and develop positive learning behaviors such as persistence, effective study habits, and self-regulation.

School administrators have to support professional development programs and training workshops that help

teachers strengthen the use of collaborative learning approaches in mathematics instruction.

Future researchers may conduct similar studies using a larger sample size or different research designs to further examine the effect of collaborative learning approaches on students' mathematical skills.

REFERENCE

- [1]. Wakhata, R., Balimuttajjo, S., & Mutarutinya, V. (2024). Students' attitudes and performance in mathematics word problems. PLoS ONE, 19(2), e0278593. <https://doi.org/10.1371/journal.pone.0278593>