

Teachers' Practices on Collaborative Approaches and Learners' Performance in Mathematics

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ABSTRACT

Mathematics remains one of the most challenging subjects in Philippine basic education, as shown by learners' persistent difficulties in achieving proficiency in large-scale assessments. This study aimed to determine the extent of teachers' practices on collaborative approaches and learners' performance in Mathematics in the Division Achievement Test (DAT) in select districts of Misamis Oriental during the School Year 2024-2025. Specifically, this aimed to describe the respondents' profile; find out the extent of teachers' practices on collaborative approaches; examine the level of learners' performance in Mathematics in the DAT; determine the significance between extent of teachers' practices on collaborative approaches and learners' performance in the DAT in Mathematics; and determine the significance between the extent of teachers' collaborative approaches and each of their profile. Using a descriptive-correlational research design, the study involved 160 purposively selected Grade 5 Mathematics teachers across five districts. Data were collected through a researcher-made, validated questionnaire, while learners' DAT results were analyzed as the performance measure. Statistical tools included weighted mean, standard deviation, Pearson's r , and chi-square tests.

Results revealed that group problem-solving was the most highly practiced strategy, while gamification was the least implemented. Learners' DAT performance varied, with a substantial number falling under the "Did Not Meet Expectations" category. A significant positive relationship was established between the extent of teachers' collaborative practices and learners' performance, while teacher-related factors also significantly influenced practice implementation. It recommended future researchers may explore further the impact of gamification on learners' motivation, problem-solving skills, and long-term retention in Mathematics.

Keywords: Practices, Collaborative Approaches, Performance in Mathematics

1. INTRODUCTION

Background of the Study

Mathematics remains a challenging subject in the Philippines, with learners showing low performance in assessments like the Division Achievement Test (DAT). This highlights the need for more effective, learner-centered teaching strategies. In response, DepEd implemented the PPST (DepEd Order No. 42, s.

2017) and the MATATAG Curriculum (DepEd Order No. 13, s. 2023), both promoting collaborative instruction.

Despite these reforms, teachers still face issues such as large class sizes, limited resources, and diverse learner needs. Collaborative strategies like peer tutoring, group problem-solving, think-pair-share, project-based learning, and gamification have been shown to improve engagement and achievement (Flores, 2022; Delos Reyes, 2021).

However, implementation in Misamis Oriental remains inconsistent due to training and resource gaps. This study examines teachers' use of collaborative strategies, their relationship with DAT performance, and the influence of teacher profiles on instructional practices.

The study aims to identify strengths and gaps to support future training and strengthen collaborative, learner-centered Mathematics instruction aligned with DepEd reforms.

Literature and Related Studies

This section presents a thematic review of literature related to collaborative approaches in Mathematics instruction and their influence on teaching practices and learner performance. The themes are organized according to the variables in the study's conceptual framework.

Respondents' Profile

Teacher-related factors such as age, sex, position, educational attainment, trainings attended, and teaching experience influence the implementation of collaborative teaching approaches in Mathematics. These characteristics affect teachers' openness to innovation, instructional practices, and effectiveness in improving student learning outcomes.

Age

Studies show that age influences instructional strategies and learning outcomes in Mathematics. Björklund et al. (2020) emphasized the importance of age-appropriate strategies in developing mathematical understanding, while Barahona et al. (2023) found that cross-age peer tutoring improves younger learners' mathematical performance and social development.

Sex

Research indicates that gender differences remain evident in Mathematics achievement and confidence. Becker and Hall (2023) reported persistent gender disparities, while Palomares-Ruiz and García-Perales (2020) noted that boys often show higher self-efficacy and interest in Mathematics than girls.

Position

Teachers holding leadership roles have greater influence in implementing educational reforms and innovative teaching practices. Goel (2022) highlighted the role of teachers in competency-based learning reforms, while Rawan (2025) emphasized the importance of department heads and coordinators in integrating technology and innovative strategies in Mathematics instruction.

Highest Educational Attainment

Higher educational attainment is associated with more effective teaching practices and improved student performance. The National Center for Education Statistics (2022) reported that teachers with postgraduate

degrees are more likely to use innovative instructional methods and participate in professional development.

Trainings and Seminars Attended

Continuous professional development enhances teachers' instructional competence. The International Seminar on Applied Mathematics and Mathematics Education 2020 emphasized the importance of training in technology integration and innovative strategies, while Goel (2022) stressed that regular seminars help teachers address diverse learner needs effectively.

Number of Years in Teaching Mathematics

Teaching experience contributes to stronger classroom management and better implementation of collaborative learning. Medina and Tolentino (2021) found that experienced teachers manage collaborative activities more effectively, while Castillo (2023) noted that veteran teachers use more diverse instructional strategies.

Practices on Collaborative Approaches

Collaborative approaches improve student engagement, critical thinking, and mathematical understanding. Maharani et al. (2020) found that collaborative strategies such as Think Pair Share and Three Steps Interview improved mathematics achievement. Similarly, Palisbo et al. (2025) reported improved learner participation and performance through collaborative rotation techniques.

Peer Tutoring

Peer tutoring strengthens students' understanding through interaction and feedback. Cardino and Ortega-Dela Cruz (2020) found that it enhances comprehension and creates a supportive learning environment. Sabando (2022) added that peer tutoring improves communication skills and academic engagement.

Group Problem-Solving

Group problem-solving develops collaboration and critical thinking. Ehrenfeld (2020) emphasized that collaborative discussions deepen mathematical understanding, while Borko and Potari (2024) noted that group activities improve retention and accountability.

Think-Pair-Share

Think-pair-share promotes active participation and communication. Horn and Garner (2022) found that this strategy helps students clarify ideas and engage in meaningful discussions. Vedder-Weiss et al. (2022) also noted its role in developing problem-solving and communication skills.

Project-Based Learning

Project-based learning enables students to apply Mathematics in real-life contexts. Siller and Ahmad (2024) reported that PBL improves engagement and understanding, while Van Es (2022) highlighted its effectiveness in developing critical thinking and teamwork.

Gamification

Gamification increases student motivation and participation in Mathematics. Alrajeh and Shindel (2020) found that game-based elements make learning more interactive, while Kazemi and Hubbard (2021) emphasized its role in strengthening teamwork and problem-solving skills.

Learners' Performance in Mathematics (DAT)

Several studies identified factors affecting learners' Mathematics performance. Mijares (2022) highlighted the importance of parental involvement in improving academic achievement. The National Center for Education Statistics (2022) reported declines in Mathematics performance during the COVID-19 pandemic due to disruptions in learning. Aksan (2021) discussed the challenges of modular learning and the need for adaptive teaching strategies.

In addition, a 2020 systematic review emphasized that connecting prior knowledge, visual representations, and real-life experiences improves students' understanding of mathematical concepts and performance in standardized tests such as the DAT. Collectively, these studies highlight the importance of collaborative and adaptive teaching approaches in improving Mathematics learning outcomes.

Objectives

This study aimed to determine the extent of teachers' collaborative approaches and learners' performance in Mathematics in the Division Achievement Test (DAT) in selected districts of Misamis Oriental during School Year 2024–2025. Specifically, it sought to:

1. describe the respondents' profile;
2. determine the extent of collaborative approaches used by teachers;
3. examine learners' performance in the DAT;
4. determine the relationship between collaborative approaches and learners' performance; and
5. determine the relationship between collaborative approaches and teachers' profile variables.

Theoretical Framework

This study is anchored on the Constructivist Theory of Jean Piaget, which states that learners actively construct knowledge through experience, interaction, and reflection. In Mathematics education, collaborative approaches such as peer tutoring, group problem-solving, think-pair-share, project-based learning, and gamification encourage active participation, teamwork, and deeper understanding. These strategies support critical thinking and meaningful learning, making Constructivist Theory an appropriate foundation for examining how collaborative teaching approaches influence learners' Mathematics performance in the DAT.

Conceptual Framework

This study is guided by DepEd policies promoting learner-centered and collaborative instruction, including the Philippine Professional Standards for Teachers (PPST), the MATATAG Curriculum, and the Continuous Improvement Program.

The independent variables are collaborative approaches such as peer tutoring, group problem-solving, think-pair-share, project-based learning, and gamification. The dependent variable is learners' performance in Mathematics in the DAT. Moderating variables include teachers' age, sex, position, educational attainment, trainings attended, and years of teaching experience.

The framework assumes that collaborative approaches improve learners' Mathematics performance and that teacher characteristics may influence the implementation of these strategies.

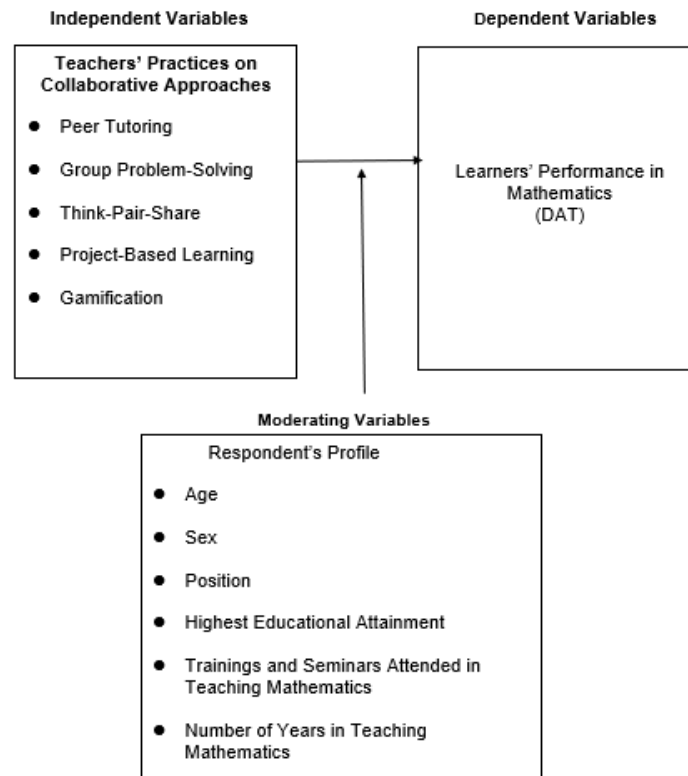


Figure 1. Schematic Presentation Showing the Interplay between the Independent, Dependent, and Moderating Variables

Statement of the Problem

This study aimed to determine the extent of teachers' practices on collaborative approaches and learners' performance in Mathematics in the Division Achievement Test (DAT) in select districts of Misamis Oriental during the School Year 2024-2025.

Specifically, it sought to answer the following questions:

1. What is the respondents' profile in terms of age, sex, position, highest educational attainment, trainings and seminars attended in teaching mathematics, and number of years in teaching Mathematics?
2. To what extent are the teachers' practices on collaborative approaches as to peer tutoring, group problem-solving, think-pair-share, project-based learning, and gamification relate to learners' performance?
3. What is the level of learners' performance in Mathematics in the Division Achievement Test?
4. Is there a significant relationship between the extent of teachers' practices on collaborative approaches and learners' performance in the DAT in Mathematics?
5. Is there a significant relationship between the extent of teachers' practices on collaborative approaches and each of their profile?

Hypothesis

Problems 1, 2, and 3 are hypothesis-free. On the basis of Problems 4 and 5, the null hypotheses were tested at a 0.05 level of significance.

Ho1: There is no significant relationship between the extent of teachers' practices on collaborative approaches and learners' performance in Mathematics.

Ho2: There is no significant relationship between the extent of teachers' practices on collaborative approaches and each of their profile.

Significance of the Study

This study on teachers' collaborative approaches and learners' Mathematics performance in the Division Achievement Test (DAT) may benefit policymakers, school administrators, teachers, students, parents, and future researchers. The findings may help improve educational policies, teacher training, instructional practices, student engagement and achievement, parental support, and future educational studies.

Scope and Limitations

This study focused on the collaborative teaching practices of 160 elementary Mathematics teachers in selected districts of Misamis Oriental during School Year 2024–2025. It examined peer tutoring, group problem-solving, think-pair-share, project-based learning, and gamification in relation to learners' DAT performance. Teachers' profile variables were also considered. The study was limited to the selected districts and findings may not be generalized beyond the study context.

METHODOLOGY

This section covers the research design, study setting, research respondents, sampling technique, research instrument, validity and reliability, data gathering procedure, system of scoring, statistical treatment of data, and ethical considerations.

Research Design

This study used a descriptive-correlational research design to examine the relationship between teachers' collaborative teaching practices and learners' performance in the Division Achievement Test (DAT) in Mathematics. The descriptive aspect assessed the extent of teachers' use of collaborative strategies such as peer tutoring, group problem-solving, think-pair-share, project-based learning, and gamification, including teachers' profile variables. The correlational aspect determined the relationship between collaborative practices and learners' DAT performance. This design was appropriate in analyzing relationships among variables without manipulating them.

Study Setting

This study was conducted in five selected districts under the Department of Education Division of Misamis Oriental: Alubijid East District, Alubijid West District, Laguindingan District, Opol East District, and Opol West District. These districts include public elementary schools with diverse teaching environments and learner backgrounds, making them suitable for examining collaborative teaching approaches and learners' Mathematics performance in the DAT.

Research Respondents

This study involved Grade 5 Mathematics teachers from five districts within the Division of Misamis Oriental: Alubijid East District, Alubijid West District, Laguindingan District, Opol East District, and Opol West District. A total of one hundred sixty (160) teachers served as respondents for the School Year 2024–2025. Only teachers specifically assigned to teach Grade 5 Mathematics were included to ensure that the study accurately captures instructional practices and their relationship to learners' performance at this level.

The distribution of the respondents by districts and schools is shown in Table A.

Table A
Distribution of Respondents

District Code	School Code	Respondents
A	A ₁ , A ₂ , A ₃ , A ₄ , A ₅ , A ₆ , A ₇ , A ₈	30
B	B ₁ , B ₂ , B ₃ , B ₄ , B ₅ , B ₆ , B ₇ , B ₈ , B ₉ , B ₁₀	25
C	C ₁ , C ₂ , C ₃ , C ₄ , C ₅ , C ₆ , C ₇ , C ₈ , C ₉ , C ₁₀ , C ₁₁	26
D	D ₁ , D ₂ , D ₃ , D ₄ , D ₅ , D ₆	40
E	E ₁ , E ₂ , E ₃ , E ₄ , E ₅ , E ₆ , E ₇ , E ₈ , E ₉ , E ₁₀	39
Total		160

Sampling Technique

This study utilized purposive sampling in selecting the respondents. The participants were 160 Grade 5 Mathematics teachers from selected public elementary schools in Alubijid East District, Alubijid West District, Laguindingan District, Opol East District, and Opol West District under the Department of Education Division of Misamis Oriental. The respondents were chosen because they were directly involved in teaching Mathematics and implementing collaborative strategies such as peer tutoring, group problem-solving, think-pair-share, project-based learning, and gamification.

Research Instrument

The study used a researcher-made questionnaire as the primary research instrument. Part I gathered the respondents' demographic and professional profile. Part II assessed the extent of teachers' collaborative practices using a four-point Likert scale. Part III determined the learners' performance in the Division Achievement Test (DAT) in Mathematics.

Validity and Reliability

The questionnaire underwent expert validation to ensure content validity, clarity, and relevance. A pilot test was conducted among 30 teachers who were not included in the actual study. Cronbach's Alpha was used to test reliability, with results indicating satisfactory internal consistency.

Data Gathering Procedure

The researcher secured permission from the Dean of the School of Graduate and Professional Studies of PHINMA-Cagayan de Oro College and the Schools Division Superintendent of Misamis Oriental. After approval, permission was obtained from school heads before distributing the questionnaires. Respondents were informed of the voluntary nature and confidentiality of the study. The accomplished questionnaires were then collected, recorded, and analyzed.

Statistical Treatment of Data

The data gathered were analyzed using appropriate statistical tools. Frequency and percentage described the respondents' profile, while weighted mean determined the extent of teachers' collaborative practices. Mean and standard deviation measured learners' performance in the Division Achievement Test (DAT) in Mathematics. Pearson Product-Moment Correlation Coefficient (Pearson r) examined the relationship between teachers' collaborative practices and learners' DAT performance, while the Chi-square Test of Independence (χ^2) determined the relationship between respondents' profile variables and collaborative teaching practices. All analyses used a 0.05 level of significance.

Ethical Considerations

The study observed ethical standards to protect the rights and welfare of participants. Informed consent was secured, and participation was voluntary. Confidentiality and anonymity were maintained using codes instead of personal identifiers. Approval from concerned authorities, including the Department of Education Division Office and school administrators, was obtained before data collection. All data were used solely for academic purposes, and findings were presented honestly and objectively.

RESULTS AND DISCUSSION

This section presents the results, discussions, conclusion and recommendation that make up the significant constituents of a comprehensive research paper. It allows also the interpretation and analysis of data of the results, and putting its implications, insights and significance within the existing literature of this study.

Problem 1. What is the respondents' profile in terms of age, sex, position, highest educational attainment, trainings and seminars attended in teaching Mathematics, and number of years in teaching Mathematics?

Table 1
Distribution of Respondents' Profile in terms of Age

Category	Frequency	Percentage
51 – 60 years old	11	6.88
41 – 50 years old	38	23.75
31 – 40 years old	83	51.87
22 – 30 years old	28	17.50
Total	160	100.00

Table 1 shows that most respondents are 31–40 years old, with 83 teachers (51.87%), indicating that the majority are mid-career professionals. This suggests that many Mathematics teachers are already experienced yet still open to adopting collaborative and learner-centered teaching strategies. This supports

the idea that mid-career teachers are more adaptable and effective in implementing innovative instructional approaches such as collaborative learning.

In contrast, only 11 respondents (6.88%) belong to the 51–60 age group, indicating fewer senior teachers in active classroom roles, possibly due to retirement or reassignment. This may limit mentorship opportunities and the transfer of experience to younger teachers, while also suggesting a need for continuous professional development to help veteran educators adapt to modern teaching approaches.

Table 2
Distribution of Respondents' Profile in terms of Sex

Category	Frequency	Percentage
Male	36	22.50
Female	124	77.50
Total	160	100.00

Table 2 shows the distribution of respondents according to sex. Female Mathematics teachers comprised the majority with 124 respondents (77.50%), while male teachers accounted for only 36 respondents (22.50%). This indicates that the teaching profession in the surveyed districts is predominantly female, reflecting the common trend in Philippine basic education. The high proportion of female teachers may contribute to more collaborative, inclusive, and student-centered classroom environments that support effective Mathematics learning.

The findings are supported by studies of Becker and Hall (2023) and Zalsos and Corpuz (2024), which emphasized that female educators are often more engaged in reflective teaching, collaboration, and learner-centered instructional practices. Meanwhile, the smaller proportion of male teachers suggests less diversity in teaching approaches. According to Kazemi and Hubbard (2021), male teachers tend to incorporate more competitive and game-based strategies in Mathematics instruction. Therefore, a more balanced gender distribution among teachers may provide students with varied teaching styles and richer learning experiences.

Table 3
Distribution of Respondents' Profile in terms of Position

Category	Frequency	Percentage
Master Teacher II	19	11.87
Master Teacher I	36	22.50
Teacher III	23	14.38
Teacher II	28	17.50
Teacher I	54	33.75
Total	160	100.00

Table 3 presents the distribution of respondents according to their teaching positions. The highest frequency was recorded among Teacher I respondents, with 54 teachers (33.75%) comprising the largest portion of the sample. This indicates that many Grade 5 Mathematics teachers are in entry-level positions and are directly engaged in daily classroom instruction. Their frequent interaction with students places them in a strong position to implement and assess collaborative learning strategies. Being early in their

careers, these teachers are also more open to innovative and student-centered approaches such as cooperative learning and peer-assisted activities. This supports the findings of Castillo (2023), who noted that early-career teachers are generally more receptive to modern and collaborative teaching methods. Meanwhile, Master Teacher II respondents recorded the lowest frequency with only 19 teachers (11.87%). This suggests that senior educators are less involved in direct classroom teaching because they often perform leadership, mentoring, and administrative responsibilities. Although they possess extensive teaching experience, their limited classroom engagement may reduce their direct implementation of collaborative learning strategies. According to Rawan (2025), teachers in higher career stages are more focused on instructional supervision and school improvement functions. Thus, there is a need for senior teachers to continue supporting and modeling effective collaborative teaching practices for novice educators.

Table 4
Distribution of Respondents' Profile in terms of Highest Educational Attainment

Category	Frequency	Percentage
Doctorate Degree	11	6.87
Master's Degree w/ Doctorate degree units	15	9.38
Master's Degree	24	15
Bachelor's Degree w/ MA Degree units	16	10.00
Bachelor's Degree	94	58.75
Total	160	100.00

Table 4 presents the highest educational attainment of the respondents. The majority, 94 teachers (58.75%), hold only a bachelor's degree, indicating that more than half of the Mathematics teachers have not pursued graduate studies. This suggests limited exposure to advanced and research-based teaching strategies, which may affect the implementation of innovative and collaborative instructional approaches. According to the National Center for Education Statistics (2022), teachers with graduate degrees are more likely to apply research-informed and innovative teaching practices.

Meanwhile, only 11 respondents (6.87%) possess a Doctorate degree, representing the lowest frequency. Although few in number, these teachers may serve as instructional leaders, mentors, and curriculum specialists due to their advanced academic preparation. The United States Census Bureau (2021) noted that educators with doctoral degrees often contribute to educational planning, professional development, and instructional improvement initiatives.

Table 5
Distribution of Respondents' Profile in terms of Trainings and Seminars Attended in Teaching Mathematics

Category	Frequency	Percentage
7 – 10 times	57	35.63
4 – 6 times	65	40.62
1 – 3 times	38	23.75
Total	160	100.00

Table 5 presents the frequency of Mathematics-related trainings and seminars attended by the respondents. The highest proportion, 65 teachers (40.62%), attended 4 to 6 trainings, indicating that many respondents actively participate in professional development activities. This suggests a strong commitment to improving instructional practices and gaining updated knowledge on collaborative and student-centered teaching strategies in Mathematics. According to Fadzil and Osman (2025), frequent participation in professional development enhances teachers' confidence and competence in implementing collaborative learning approaches.

Meanwhile, 38 respondents (23.75%) attended only 1 to 3 trainings, representing the lowest frequency. This indicates limited exposure to professional development, which may result from lack of access, institutional support, or workload demands. Teachers with fewer trainings may rely more on traditional teaching methods and may have difficulty applying innovative instructional strategies. Mijares (2022) emphasized that limited professional development weakens teachers' understanding of modern teaching practices and highlights the need for broader access to training opportunities.

Table 6**Distribution of Respondents' Profile in terms of Number of Years Teaching Mathematics**

Category	Frequency	Percentage
16 years and above	17	10.63
11 – 15 years	28	17.50
6 – 10 years	94	58.75
1- 5 years	21	13.12
Total	160	100.00

Table 6 presents the respondents' teaching experience in Mathematics. The highest frequency, 94 teachers (58.75%), falls within the 6–10 years range, indicating that most respondents are in a stage of teaching experience that combines instructional competence with openness to innovation. This suggests that these teachers are well-positioned to implement collaborative learning strategies, as they already possess classroom management skills and varied instructional techniques while remaining adaptable to new pedagogical approaches. Medina and Tolentino (2021) found that teachers with 6 to 10 years of experience are often highly effective in collaborative instruction because they balance refined teaching skills with flexibility and innovation.

Meanwhile, only 17 respondents (10.63%) had 16 years and above teaching experience, representing the lowest frequency. This suggests that fewer veteran teachers remain in direct classroom instruction, possibly due to retirement or administrative assignments. Although experienced teachers possess strong pedagogical knowledge, they may rely more on traditional teaching methods unless provided with continuous professional development. According to Horn and Garner (2022), veteran educators may need institutional support to adapt their expertise to modern collaborative teaching practices.

Problem 2. To what extent do teachers' practices on collaborative approaches as to peer tutoring, group problem-solving, think-pair-share, project-based learning, and gamification relate to learners' performance?

Table 7
Distribution of Teachers' Extent of Practices on Collaborative Approaches as to Peer Tutoring

Indicators	Mean	SD	Description
I assign advanced learners to tutor struggling classmates during Math activities.	3.28	0.74	Always
I rotate peer tutors regularly to encourage inclusivity.	3.15	0.72	Often
I provide guidelines for effective peer tutoring in Math.	3.30	0.76	Always
I monitor the interactions of peer tutors to ensure correct explanations.	3.18	0.77	Often
I give tasks appropriate to the level of both the tutor and the tutee.	3.25	0.74	Often
I used Peer tutoring during review sessions before Math exams.	3.34	0.78	Always
I train students to ask guiding questions when tutoring in Math.	3.20	0.76	Often
I encourage feedback from tutees on their peer tutors.	3.27	0.85	Always
I observe peer tutoring sessions to assess their effectiveness.	3.22	0.75	Often
I let students reflect on their peer tutoring experiences.	3.25	0.78	Often
I pair students based on their Mathematics performance levels.	3.18	0.74	Often
I schedule regular peer tutoring time during Math classes.	3.30	0.77	Always
I use peer tutoring to reteach difficult Math concepts.	3.19	0.75	Often
I reward students who effectively tutor their peers in Math.	3.23	0.78	Often
I integrate Peer tutoring into my weekly Math lesson plans.	3.28	0.76	Always
Overall	3.24	0.76	Often
Legend: 3.26-4.00 Always / Highly Practiced	1.76-2.50	Sometimes	/ Slightly Practiced
2.51-3.25 Often / Practiced	1.00-1.75	Never	/ Not Practiced

Table 7 presents the respondents' extent of practices on collaborative approaches in Mathematics as to peer tutoring, with an overall mean of 3.24 (SD = 0.76), described as Often and interpreted as Practiced. This indicates that peer tutoring is regularly used by Mathematics teachers, although its implementation varies among classrooms. The findings suggest that teachers recognize peer tutoring as an effective

strategy for promoting collaboration and improving mathematical understanding, but its application still needs to be strengthened for greater consistency and inclusivity. According to Moliner et al. (2020) and Van der Kleij et al. (2020), peer tutoring enhances achievement, collaboration, and conceptual understanding when properly guided and consistently implemented.

The highest mean was recorded in the indicator, “I use peer tutoring during review sessions before Math exams” ($M = 3.34, SD = 0.78$), interpreted as Highly Practiced. This shows that teachers strongly value peer tutoring during assessment preparation because it helps reinforce learning and improve retention. Meanwhile, the lowest mean was noted in “I rotate peer tutors regularly to encourage inclusivity” ($M = 3.15, SD = 0.72$), interpreted as Practiced. This suggests that role rotation is less consistently implemented, limiting equal participation among learners. Cardino and Ortega-Dela Cruz (2020) emphasized that structured rotation in peer tutoring promotes inclusivity, empathy, and balanced cognitive engagement among students.

Table 8
Distribution of Teachers’ Extent of Practices on Collaborative Approaches as to Group Problem-Solving

Indicators	Mean	SD	Description
I assign real-life Math problems for group solving.	3.38	0.76	Always
I organize students into diverse groups for problem-solving tasks.	3.30	0.74	Always
I provide clear steps for group problem-solving activities.	3.35	0.77	Always
I allow students to present their group solutions in class.	3.40	0.80	Always
I assess both group process and final solution.	3.28	0.75	Always
I encourage students to critique and refine group solutions.	3.22	0.77	Often
I integrate group tasks in every Math unit.	3.34	0.75	Always
I assign roles within groups (e.g., leader, recorder, presenter).	3.36	0.76	Always
I give feedback on group collaboration and teamwork.	3.29	0.77	Always
I allow time for group reflection after solving problems.	3.18	0.78	Often
I use scoring rubrics for evaluating group problem-solving.	3.32	0.80	Always
I observe and document group dynamics during Math tasks.	3.31	0.76	Always
I relate group activities to actual Math performance tasks.	3.24	0.77	Often
I involve groups in decision-making during Math discussions.	3.28	0.75	Always

I check students' understanding during pair discussions.	3.23	0.76	Often
I use Think-Pair-Share during Math assessments.	3.27	0.78	Always
I encourage respect and active listening in discussions.	3.35	0.82	Always
I incorporate Think-Pair-Share in solving word problems.	3.31	0.78	Always
I track participation in Think-Pair-Share.	3.19	0.75	Often
I give feedback after the "share" phase.	3.25	0.76	Often
I use Think-Pair-Share to build mathematical vocabulary.	2.45	0.78	Sometimes
Overall	3.23	0.78	Often
Legend:	3.26-4.00 Always / Highly Practiced	1.76-2.50	Sometimes / Slightly Practiced
	2.51-3.25 Often / Practiced	1.00-1.75	Never / Not Practiced

Table 9 presents the respondents' extent of practices on Think-Pair-Share (TPS) in Mathematics, which obtained an overall mean of 3.23 (SD = 0.78), described as Often and interpreted as Practiced. This indicates that TPS is regularly used in classrooms, although its implementation is not fully consistent. The findings suggest variation in how teachers apply its phases, with the "think" and "pair" stages being more emphasized than the "share" stage. This implies that TPS is commonly used to promote student engagement but not always maximized for deeper conceptual learning. According to Cooper (2021) and Atmojo et al. (2023), TPS is most effective when all phases are systematically implemented to enhance participation, collaboration, and communication skills.

The highest mean was recorded in "I provide time for reflection after each Think-Pair-Share activity" (M = 3.36, SD = 0.80), interpreted as Highly Practiced. This shows that teachers value reflection as an important step for reinforcing learning and clarifying ideas. Meanwhile, the lowest mean was in "I use Think-Pair-Share to build mathematical vocabulary" (M = 2.45, SD = 0.78), interpreted as Slightly Practiced. This suggests limited use of TPS for developing academic language, which may reduce opportunities for students to strengthen mathematical vocabulary and discourse skills. Research by Atmojo et al. (2023) and Cooper (2021) highlights that integrating structured reflection and vocabulary support within TPS enhances both conceptual understanding and communication in Mathematics.

Table 10
Distribution of Teachers' Extent of Practices on Collaborative Approaches as to Project-Based Learning

Indicators	Mean	SD	Description
I assign Math projects that solve real-world problems.	3.25	0.78	Often
I integrate multiple Math competencies in project tasks.	3.28	0.76	Always

I allow learners to choose topics related to Math.	3.22	0.77	Often
I require project proposals before implementation.	3.24	0.76	Often
I give rubrics for assessing Math projects.	3.30	0.78	Always
I provide regular feedback during project development.	3.29	0.80	Always
I encourage the use of digital tools in Math projects.	2.40	0.76	Sometimes
I link projects to learners' personal experiences in Math.	3.26	0.78	Always
I allow collaborative work in completing Math projects.	3.34	0.83	Always
I assess both the process and the final output.	3.30	0.79	Always
I schedule public presentations of Math projects.	3.23	0.76	Often
I encourage students to reflect on their project learning.	3.31	0.80	Always
I adjust projects based on students' strengths and interests.	3.32	0.79	Always
I relate projects to current issues involving Math.	3.20	0.78	Often
I use project-based learning as a performance-based assessment.	3.29	0.79	Always
Overall	3.22	0.78	Often
Legend:	3.26-4.00 Always / Highly Practiced	1.76-2.50	Sometimes /
	Slightly Practiced		
	2.51-3.25 Often / Practiced	1.00-1.75	Never / Not Practiced

Table 10 presents the extent of teachers' practices on project-based learning (PBL), with an overall mean of 3.22 (SD = 0.78), described as Often and interpreted as Practiced. This indicates that PBL is regularly used in Mathematics classrooms, although not as consistently as other collaborative approaches. The findings suggest that while teachers recognize the value of PBL in promoting authentic and meaningful learning, factors such as limited resources, time constraints, and insufficient training may affect its consistent implementation. According to Zhang et al. (2023) and Rehman et al. (2024), PBL enhances achievement, critical thinking, collaboration, and other 21st-century skills when supported by effective teacher preparation and guidance.

The highest mean was recorded in "I allow collaborative work in completing Math projects" (M = 3.34, SD = 0.83), interpreted as Highly Practiced. This shows that teachers strongly encourage teamwork and shared problem-solving in project activities. Meanwhile, the lowest mean was found in "I encourage the use of digital tools in Math projects" (M = 2.40, SD = 0.76), interpreted as Slightly Practiced. This suggests limited integration of technology in project-based tasks, possibly due to inadequate resources, limited digital literacy, or lack of training. Zhang et al. (2023) emphasized that integrating digital tools in PBL

improves collaboration, data analysis, and authentic learning experiences, but effective implementation depends on teachers’ technological competence and institutional support.

Table 11
Distribution of Teachers’ Extent of Practices on Collaborative Approaches as to Gamification

Indicators	Mean	SD	Description
I incorporate game elements in Math lessons (e.g., points, levels).	3.20	0.75	Often
I use digital games to reinforce Math skills.	3.15	0.77	Often
I design board games tailored to Math competencies.	2.35	0.75	Sometimes
I use competitive games to motivate learners in Math.	3.22	0.80	Often
I give rewards for game performance in Math.	3.18	0.78	Often
I align games with learning objectives in Math.	3.24	0.79	Often
I rotate game activities to maintain student engagement.	3.16	0.81	Often
I use student feedback to improve Math games.	3.20	0.76	Often
I ensure fairness in game-based Math activities.	3.26	0.80	Always
I combine games with traditional assessments.	3.21	0.78	Often
I include games as review tools before Math exams.	3.18	0.76	Often
I set clear rules for each game-based Math activity.	3.30	0.83	Always
I encourage teamwork during Math games.	3.25	0.77	Often
I facilitate reflection after game-based learning.	3.28	0.79	Always
I document students’ performance in gamified Math tasks.	3.22	0.78	Often
Overall	3.16	0.78	Often

Legend: 3.26-4.00 Always / Highly Practiced 1.76-2.50 Sometimes / Slightly Practiced
2.51-3.25 Often / Practiced 1.00-1.75 Never / Not Practiced

Table 11 presents the extent of teachers’ practices on gamification in Mathematics, with an overall mean of 3.16 (SD = 0.78), described as Often and interpreted as Practiced. This indicates that gamification is moderately used in classrooms, but not yet consistently implemented compared to more traditional collaborative strategies. The findings suggest that teachers commonly apply basic game elements such as points, rewards, and competition, while more complex gamified systems remain limited. According to Khoshnoodifar et al. (2023) and Ortiz-Rojas et al. (2025), gamification enhances motivation and engagement when aligned with clear learning objectives and properly integrated into instruction.

The highest mean was recorded in “I set clear rules for each game-based Math activity” (M = 3.30, SD = 0.83), interpreted as Highly Practiced. This shows that teachers prioritize structure and classroom management to ensure that gamified activities remain focused and purposeful. Meanwhile, the lowest mean was found in “I design board games tailored to Math competencies” (M = 2.35, SD = 0.75),

interpreted as Slightly Practiced. This suggests limited creation of customized games due to time constraints, workload, and lack of resources or training. Research by Khoshnoodifar et al. (2023) and Ortiz-Rojas et al. (2025) highlights that while customized gamification can deepen learning and engagement, it requires significant support and capacity-building for effective implementation.

Table 12

Summary Distribution of the Teachers’ Extent of Practices on Collaborative Approaches in Mathematics

Variable	Mean	SD	Interpretation
Peer Tutoring	3.24	0.76	Practiced
Group-Problem Solving	3.29	0.77	Highly Practiced
Think-Pair-Share	3.23	0.78	Practiced
Project-Based Learning	3.22	0.78	Practiced
Gamification	3.16	0.78	Practiced
Overall	3.23	0.77	Practiced

Legend: 3.26-4.00 Always / Highly Practiced 1.76-2.50 Sometimes / Slightly Practiced
 2.51-3.25 Often / Practiced 1.00-1.75 Never / Not Practiced

Table 12 shows the summary of teachers’ collaborative practices in Mathematics with an overall mean of 3.23 (SD = 0.77), interpreted as Practiced. This means that teachers often use collaborative strategies, but not consistently across all classrooms. The results suggest moderate variation in implementation due to factors such as time, resources, and classroom conditions, indicating the need for further support and training.

Group Problem-Solving had the highest mean (M = 3.29), making it the most frequently used strategy, while Gamification had the lowest (M = 3.16), showing it is less commonly applied due to limited resources and familiarity.

Overall, collaborative approaches are present in instruction but still need stronger and more consistent implementation.

Problem 3. What is the level of learners’ performance in Mathematics in the Division Achievement Test?

Table 13

Distribution of the Level of Learners’ Performance in Mathematics in the Division Achievement Test

Performance Level	Frequency	Percentage	Mean	Standard Deviation
Outstanding	58	36.25	95	2.89
Very Satisfactory	17	10.63	87	1.15
Satisfactory	41	25.62	82	1.05
Fairly Satisfactory	36	22.50	77	0.99
Did Not Meet Expectations	8	05.00	72	0.86
Total	160	100.00	82.6	1.39

Legend: 90-100 Outstanding/Demonstrates mastery of the competencies with no or minimal errors

85-89 Very Satisfactory/Shows solid understanding of concepts;meets grade-level expectations with minor errors

80-84 Satisfactory/Has basic understanding; meets the minimum required proficiency level

75-79 Fairly Satisfactory/Shows partial understanding;needs support to fully meet expectations

Below 75 Did Not Meet Expectations/Lacks mastery of fundamental concepts;requires

intensive remediation

Table 13 presents learners’ performance in the Division Achievement Test (DAT) in Mathematics, with an overall mean of 82.6 (SD = 1.39), interpreted as Satisfactory. This indicates that learners generally demonstrate adequate understanding of mathematical concepts, though improvement is still needed to reach higher proficiency levels.

Most learners (36.25%) achieved an Outstanding rating, while others were Satisfactory (25.62%) and Fairly Satisfactory (22.5%). Only 5% did not meet expectations, suggesting that the majority of learners (95%) reached at least basic proficiency. This may reflect the positive influence of collaborative strategies such as Think-Pair-Share, Group Problem-Solving, and Gamification.

However, 5% of learners who did not meet expectations indicate the need for targeted remediation and differentiated instruction. Studies by Lucas and Manlapig (2021) and Sullivan et al. (2020) emphasize that struggling learners require structured support, scaffolding, and teacher-guided collaboration to improve outcomes.

Problem 4. Is there a significant relationship between the extent of teachers’ practices on collaborative approaches and learners’ performance in the DAT in Mathematics?

Table 14

Test of Relationship Between the Extent of Teachers’ Practices on Collaborative Approaches and Learners’ Performance in the DAT in Mathematics

Collaborative Approaches	Learners’ Performance in Mathematics (DAT)		
	r-value		p-value
	Interpretation		
Peer Tutoring	0.8900	0.0141	S
Group Problem-Solving	0.8001	0.0201	S
Think-Pair-Share	0.6014	0.0301	S
Project-Based Learning	0.9001	0.0103	S

Gamification 0.7200 0.0304 S

Legend: S – Significant NS – Not Significant

Table 14 presents the relationship between teachers’ collaborative practices and learners’ DAT performance in Mathematics. The results show that all five strategies—Peer Tutoring, Group Problem-Solving, Think-Pair-Share, Project-Based Learning, and Gamification—have significant positive relationships with student performance, leading to the rejection of the null hypothesis. This means that increased use of collaborative approaches is associated with better Mathematics achievement.

Among the strategies, Project-Based Learning ($r = 0.9001$, $p = 0.0103$) and Peer Tutoring ($r = 0.8900$, $p = 0.0141$) showed very strong correlations, followed by Group Problem-Solving ($r = 0.8001$), Gamification ($r = 0.7200$), and Think-Pair-Share ($r = 0.6014$), all with significant p-values. The overall correlation ($r = 0.7823$, $p = 0.021$) also indicates a strong positive relationship.

These findings suggest that collaborative learning strategies meaningfully contribute to improved student outcomes in Mathematics, as they promote engagement, understanding, and active participation in learning.

Problem 5. Is there a significant relationship between the extent of teachers’ practices on collaborative approaches and each of their profile?

Table 15

Correlation Result Between the Extent of teachers’ Practices on Collaborative Approaches and each of their Profile

		Teachers’ Practices on Collaborative Approach in Mathematics					Overall
		Peer Tutoring	Group Problem-Solving	Think-Pair-Share	Problem - Based Learning	Gamification	
Age	r-value	0.9870	0.9320	0.8009	0.8032	0.8309	0.87
	p-value	0.0178	0.0103	0.0203	0.0301	0.0308	0.02
	interpretation	S	S	S	S	S	S
Sex	r-value	0.6098	0.4760	0.6054	0.5098	0.6097	0.56
	p-value	0.0309	0.1009	0.0402	0.0403	0.0402	0.05
	interpretation	S	NS	S	S	S	S

Position	r-value	0.7006	0.8023	0.6098	0.6097	0.6540	0.68
	p-value	0.0409	0.0302	0.303	0.0308	0.0209	0.09
	interpretation	S	S	NS	S	S	S
Highest Educational Attainment	r-value	0.6099	0.9033	0.9543	0.8023	0.8034	0.81
	p-value	0.0301	0.0103	0.0202	0.0203	0.0203	0.02
	interpretation	S	S	S	S	S	S
Trainings and Seminars Attended in Teaching Mathematics	r-value	0.9001	0.9899	0.7509	0.8740	0.9509	0.90
	p-value	0.0102	0.0102	0.0201	0.0306	0.0109	0.02
	interpretation	S	S	S	S	S	S
Number of Years in Teaching Mathematics	r-value	0.9860	0.8099	0.9506	0.9270	0.9203	0.92
	p-value	0.0103	0.0102	0.0102	0.0103	0.0104	0.01
	interpretation	S	S	S	S	S	S

Legend: S – Significant NS – Not Significant

Table 15 presents the relationship between teachers' profiles and their collaborative teaching practices in Mathematics. The results show that age, sex, position, educational attainment, training and seminars, and years of teaching experience all have significant relationships with at least some collaborative approaches. Thus, the null hypothesis is rejected, indicating that teachers' profiles significantly influence their instructional practices.

Age and years of experience showed strong significant relationships with all collaborative strategies, suggesting that more experienced and mature teachers are more likely to implement collaborative methods. Educational attainment and training and seminars were also significantly related to all strategies, highlighting the importance of advanced education and professional development in improving instructional practices. Position showed mixed results, while sex had limited influence, being significant only in some strategies.

Overall, the findings indicate that teachers' demographic and professional backgrounds strongly affect their use of collaborative approaches in Mathematics, with training, education, and experience emerging as key factors in effective implementation.

Discussion

The findings of this study highlight the strong connection between collaborative teaching approaches, teachers' characteristics, and learner achievement in Mathematics. Group Problem-Solving emerged as the most practiced strategy, reflecting its natural alignment with mathematical instruction and its effectiveness in promoting peer interaction and critical thinking. Conversely, Gamification was least applied, suggesting that despite its motivational potential, limited resources and preparation challenges hinder its full adoption.

Learners' Division Achievement Test (DAT) results were generally satisfactory, with many reaching "Outstanding" levels. However, a small group still struggled, underscoring the need for differentiated instruction and targeted support to ensure inclusivity.

Teachers' profiles were also found to be significant. Most were in the 31–40 age group with six to ten years of experience, representing a stage of professional maturity open to innovation. Educational attainment, training, and years of experience were strongly linked to the extent of collaborative practice, while demographic factors such as sex and position showed varied influence.

All collaborative strategies demonstrated positive relationships with DAT performance, with Project-Based Learning, Peer Tutoring, and Group Problem-Solving showing the strongest effects. This confirms that teacher preparedness and professional development are crucial in creating learner-centered classrooms where Mathematics becomes engaging and comprehensible.

In summary, collaborative strategies play a transformative role in Mathematics instruction. Group Problem-Solving remains a high-impact approach, Gamification presents untapped potential, and teacher training and academic growth stand as key institutional investments for sustaining learner success.

Conclusions

The study concludes that among the collaborative teaching strategies examined, group problem-solving was the most extensively practiced by Mathematics teachers. This preference emphasizes their inclination toward approaches that encourage learners to share ideas, reason collectively, and develop solutions as a team, creating a classroom environment that is both interactive and supportive. Learners' performance in the Division Achievement Test (DAT) reflected this positive influence, with a considerable number attaining "Outstanding" results, underscoring the effectiveness of collaborative practices in enhancing mathematical proficiency. Moreover, the study established a significant relationship between the frequency of collaborative teaching and learners' performance, indicating that these methods are not merely innovative trends but powerful tools for academic success. Teacher-related factors such as educational attainment, participation in professional training, age, and teaching experience also played a vital role in shaping the consistent application of these practices. Taken together, the results underscore the importance of continuous professional growth and institutional support in strengthening Mathematics instruction and ensuring that every learner has the opportunity to achieve their fullest potential.

Recommendations

In light of the study's findings, the following recommendations are offered to guide key stakeholders:

1. Teachers are encouraged to expand their instructional repertoire by integrating gamification strategies into Mathematics lessons. Designing simple, competency-based board games can enhance learner engagement, and this can be made more manageable through collaboration with colleagues, use of existing templates, and adaptation of low-cost materials.

2. School administrators should support teachers by providing professional development opportunities focused on game-based learning. They may also allocate resources, establish a repository of gamified materials, and recognize innovative practices to motivate teachers to sustain these approaches.
3. Learners can benefit from being directly involved in the co-creation of Math board games, turning the process into a performance task or enrichment activity. This participatory approach not only reinforces mathematical skills but also fosters creativity, teamwork, and ownership of learning.
4. Curriculum Planners and Policy Makers may consider integrating gamification more explicitly into curriculum guides and training modules. By doing so, teachers are assured of institutional backing, and the approach becomes part of systemic innovation rather than isolated practice.

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