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Teachers' Strategies in Multigrade Classes on Learners' Engagement and Mathematical Abilities

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Abstract—*This study examined the level of teachers' strategies in multigrade mathematics classes as per differentiated instruction, scaffolded instruction, peer tutoring, cooperative learning, and manipulative-based instruction; the level of learners' engagement across behavioral, cognitive, affective, and social dimensions; and the level of learners' mathematical abilities in terms of conceptual understanding, mathematical fluency, and critical thinking. It also determined whether significant relationships exist between teachers' strategies and learners' engagement, as well as between teachers' strategies and learners' mathematical abilities, and proposed an output based on the findings. The study employed a quantitative correlational research design and used a cluster sampling technique to select 116 multigrade intermediate learners from five selected schools in Cluster III of the Schools Division of Laguna. Data were collected using a validated survey questionnaire and analyzed using weighted means, standard deviations, and Pearson product-moment correlation coefficients. Findings revealed that teaching strategies were always implemented in multigrade mathematics classes. Learners also demonstrated very high levels of engagement and mathematical abilities. The results showed a significant relationship between teachers' strategies and learners' engagement. Lastly the Multigrade Mathematics Engagement-Based Instructional Model (MMEIM) was crafted based from the result of the study. Teachers' strategies in multigrade classes demonstrated significant relationships on learners' mathematical engagement and abilities that resulted in the rejection of both null hypotheses. Therefore, it was concluded that the instructional strategies employed by teachers in multigrade mathematics classes have a direct and meaningful association on learners' engagement and mathematical competence. It is recommended that teachers may strengthen instructional practices, particularly in providing individualized feedback, promoting independent learning, facilitating real-life application of mathematics, and developing higher-order thinking skills.*

Keywords— *Differentiated instruction, learner engagement, mathematical abilities multigrade teaching, teaching strategies.*

I. Introduction

In the ever-evolving landscape of education, teaching in multigrade classes remains one of the most challenging yet dynamic instructional contexts. Teachers in such environments face the responsibility of handling students from different grade levels, learning abilities, and developmental stages within a single classroom.

This study investigates how teachers' instructional strategies influence learners' engagement and mathematical abilities. The researcher believes that teachers' effective and adaptive strategies directly affect how learners participate, become motivated, and develop competence in mathematics.

Teachers in the Philippines' rural multigrade classrooms must create flexible and innovative learning experiences that meet the needs of all pupils. However, challenges such as limited resources, diverse learning paces, and varying levels of readiness often hinder effective learning. Understanding how teachers overcome these barriers by employing specific strategies is crucial in improving learners' engagement and mathematical proficiency.

This study aims to identify and analyze the strategies used by teachers in multigrade classes, specifically in teaching mathematics, and to examine how these strategies affect learners' behavioral, cognitive, affective, social, and as well as their mathematical performance in terms of conceptual understanding, fluency, and critical thinking ability. The researcher believes that by determining these relationships, this study can contribute to the improvement of instructional practices in multigrade settings, promoting both effective teaching and meaningful learning.

1.1 Statement of the Problem

Problem/s which were addressed by the research

This study aimed to determine learners' engagement and mathematical abilities using different teaching strategies in multigrade classes.

Specifically, this study sought answer the following questions:

1. What is the level of Teacher Strategies in Multigrade Classes in terms of:
   1.1 Differentiated Instruction;
   1.2 Scaffolded Instruction;
   1.3 Peer Tutoring;
   1.4 Cooperative Learning; and
   1.5 Manipulative-Based instruction?
2. What is the level of Learners' Engagement in terms of:
   2.1 Behavioral Engagement;
   2.2 Cognitive Engagement;
   2.3 Affective Engagement; and
   2.4 Social Engagement?
3. What is the level of Learners' Mathematical Abilities in terms of:
   3.1 Conceptual Understanding;
   3.2 Mathematical Fluency; and
   3.3 Critical Thinking Ability?
4. Is there a significant relationship between the teachers' strategies in multigrade classes and learners' engagement?

5. Is there a significant relationship between the teachers' strategies in multigrade classes and learners' mathematical abilities?

II. METHODOLOGY

The study employed a quantitative correlational research design and used a cluster sampling technique to select 116 multigrade intermediate learners from five selected schools in Cluster III of the Schools Division of Laguna. Data were collected using a validated survey questionnaire and analyzed using weighted means, standard deviations, and Pearson product-moment correlation coefficients.

III. RESULTS AND DISCUSSION

This part presented the results of the study on teachers' strategies in multigrade classes and their relationship to learners' engagement and mathematical abilities. The data gathered from the respondents were organized, analyzed, and interpreted in accordance with the specific research questions of the study.

Table 1. Level of Teachers' Strategies used in Multigrade Classes in terms of Differentiated Instruction

STATEMENTS	MEAN	SD	REMARKS
My teacher modifies lesson content based on my abilities and learning needs.	4.74	0.63	Always
My teacher designs varied learning activities that match different learning styles.	4.70	0.61	Always
My teacher gives tasks or problems at different levels depending on students' readiness.	4.72	0.60	Always
My teacher provides individualized feedback that addresses my specific needs.	4.59	0.71	Always
My teacher uses flexible grouping (e.g., by ability or interest) during class activities.	4.61	0.72	Always
Weighted Mean	4.67		
SD	0.48		
Verbal Interpretation	Very High		

The results presented in Table 1 revealed that the level of teaching strategies employed in multigrade mathematics classes in terms of differentiated instruction was consistently high, with an overall weighted mean of 4.67 (SD = 0.48), interpreted as Always. This indicated that teachers regularly implemented differentiated instructional practices to address the diverse learning needs of students in multigrade settings.

Among the indicators, the highest mean was obtained by the statement "My teacher modifies lesson content based on my abilities and learning needs" (M = 4.74, SD = 0.63), suggesting that content differentiation was a strongly embedded practice among teachers. This implied that teachers were highly responsive to learners' varying levels of readiness, ensuring that instruction is accessible and meaningful to all students despite differences in ability. Such practice is essential in multigrade classrooms, where heterogeneity is inherent.

On the other hand, the lowest mean, though still interpreted as Always, was recorded in the statement "My teacher provides individualized feedback that addresses my specific needs" (M = 4.59, SD = 0.71). This indicated that while individualized feedback was practiced consistently, it was comparatively less emphasized than other differentiation strategies. This might be explained by the demanding nature of multigraded instruction, in which instructors handle a number of grade levels at once, which may reduce the amount of time they have for extremely customized feedback.

Overall, the findings suggested that teachers demonstrate a strong commitment to differentiated instruction through varied strategies such as flexible grouping, tiered tasks, and the use of diverse learning activities. This aligns with the principles of differentiated instruction theory, which emphasize adapting content, process, and product based on learners' readiness, interests, and learning profiles.

Furthermore, the high level of implementation implied that differentiated instruction plays a crucial role in facilitating effective mathematics learning in multigrade contexts. By addressing individual differences, teachers were able to enhance student engagement, promote deeper understanding, and support equitable learning opportunities.

Table 2. Level of Teachers' Strategies used in Multigrade Classes in terms of Scaffolded Instruction

STATEMENTS	MEAN	SD	REMARKS
My teacher provides step-by-step guidance when introducing new mathematical concepts.	4.86	0.37	Always
My teacher uses prompts and clues to help me solve mathematical problems.	4.78	0.47	Always
My teacher gradually reduces support as I become more independent.	4.52	0.83	Always
My teacher encourages me to explain my thought process when solving problems.	4.66	0.66	Always
My teacher models problem-solving techniques before asking me to try on my own.	4.75	0.62	Always
Weighted Mean	4.71		
SD	0.36		
Verbal Interpretation	Very High		

The results presented in Table 5 indicated that the level of teaching strategies used in multigrade mathematics classes in terms of scaffolded instruction was very high, with an overall weighted mean of 4.71 (SD = 0.36), interpreted as Always.

This suggested that teachers consistently employ scaffolding techniques to support students' learning, particularly in mastering mathematical concepts and problem-solving skills.

Among the indicators, the highest mean was obtained by the statement "My teacher provides step-by-step guidance when introducing new mathematical concepts" (M = 4.86, SD = 0.37). This implied that structured and guided instruction was a dominant practice among teachers, ensuring that learners were supported during the initial stages of concept acquisition. Such an approach is particularly crucial in multigrade classrooms, where students possess varying levels of prior knowledge and cognitive readiness.

Conversely, the lowest mean, although still interpreted as Always, was recorded in the statement "My teacher gradually reduces support as I become more independent" (M = 4.52, SD = 0.83). This finding suggested that while scaffolding was consistently applied, the gradual release of responsibility to learners is relatively less emphasized. This may indicate challenges in balancing support and independence, especially in multigrade settings where teachers must simultaneously address the needs of multiple grade levels.

Overall, the findings demonstrated that scaffolded instruction was a well-established teaching practice in multigrade mathematics classes. Teachers frequently utilize strategies such as modeling, guided practice, prompting, and encouraging students to articulate their reasoning. These practices contribute to the development of students' higher-order thinking skills and conceptual understanding.

Furthermore, the high level of scaffolded instruction highlights its importance in enhancing mathematics learning in multigrade contexts. By providing guided support and gradually promoting independence, teachers help students build confidence, develop problem-solving skills, and achieve meaningful learning outcomes.

Table 3. Level of Teachers' Strategies used in Multigrade Classes in terms of Peer Tutoring

STATEMENTS	MEAN	SD	REMARKS
My teacher organizes peer tutoring sessions in mathematics.	4.55	0.75	Always
My teacher pairs high-performing learners with those who need more assistance.	4.61	0.80	Always
My teacher monitors and guides the interactions between peer tutors and tutees.	4.73	0.60	Always
My teacher encourages peer tutors to explain mathematical ideas in their own words.	4.69	0.62	Always
My teacher uses peer tutoring as a regular part of our math lessons.	4.55	0.76	Always
Weighted Mean			4.63
SD			0.51
Verbal Interpretation			Very High

The results presented in Table 3 showed that the level of teaching strategies used in multigrade mathematics classes in terms of peer tutoring was consistently high, with an overall weighted mean of 4.63 (SD = 0.51), interpreted as Always. This indicated that peer tutoring was a regularly implemented instructional strategy, reflecting teachers' efforts to promote collaborative learning and maximize available classroom resources in multigrade settings.

Among the indicators, the highest mean was obtained by the statement "My teacher monitors and guides the interactions between peer tutors and tutees" (M = 4.73, SD = 0.60). This suggested that teachers play an active role in facilitating and supervising peer tutoring activities, ensuring that interactions remain productive, accurate, and aligned with learning objectives.

Effective monitoring was essential to maintain the quality of peer-assisted learning and to prevent the reinforcement of misconceptions.

In contrast, the lowest mean was observed in the statements "My teacher organizes peer tutoring sessions in mathematics" and "My teacher uses peer tutoring as a regular part of our math lessons" (both M = 4.55, SD = 0.75 and 0.76, respectively), although still interpreted as Always. This indicated that while peer tutoring was consistently practiced, its systematic integration as a structured and routine component of instruction may be slightly less emphasized. This could be due to time constraints, classroom management challenges, or the complexity of organizing peer-assisted activities across multiple grade levels.

Overall, the findings suggested that peer tutoring was a valuable and widely utilized strategy in multigrade mathematics classrooms. Teachers effectively employ practices such as pairing students, encouraging explanation of ideas, and guiding interactions, which contribute to enhanced understanding and active engagement among learners.

Furthermore, the consistent use of peer tutoring reflected its potential to address learner diversity while fostering social interaction and collaborative problem-solving skills. By engaging students as both learners and facilitators, this strategy enhances not only academic performance but also communication and interpersonal skills.

Table 4. Level of Teachers' Strategies used in Multigrade Classes in terms of Cooperative Learning

STATEMENTS	MEAN	SD	REMARKS
My teacher uses group activities to help us solve mathematical problems.	4.66	0.72	Always
My teacher assigns specific roles to each group member during activities.	4.62	0.75	Always
My teacher encourages us to discuss and share ideas within our groups.	4.80	0.46	Always
My teacher evaluates both our individual and group contributions in group work.	4.68	0.67	Always
My teacher promotes teamwork and collaboration during mathematical activities.	4.73	0.68	Always
Weighted Mean			4.70
SD			0.47
Verbal Interpretation			Very High

The results presented In Table 4 revealed that the level of teaching strategies used in multigrade mathematics classes in terms of cooperative learning was consistently high, with an overall weighted mean of 4.70 (SD = 0.47), interpreted as Always. This indicated that cooperative learning strategies are regularly integrated into classroom instruction, highlighting teachers' emphasis on collaboration and active student engagement in multigrade mathematics settings.

Among the indicators, the highest mean was obtained by the statement "My teacher encourages us to discuss and share ideas within our groups" (M = 4.80, SD = 0.46). This suggested that teachers strongly promote open communication and idea exchange among students, which were essential components of effective cooperative learning. Such practice fostered deeper understanding as learners were able to articulate their reasoning, clarify misconceptions, and build knowledge collectively.

On the other hand, the lowest mean, although still interpreted as Always, was recorded in the statement "My teacher assigns specific roles to each group member during activities" (M = 4.62, SD = 0.75). This indicated that while group work was consistently implemented, the structured assignment of roles within groups is comparatively less emphasized. This may imply that some cooperative activities are conducted in a more flexible or less formal manner, which could affect the efficiency and accountability of group processes.

Overall, the findings demonstrated that teachers effectively utilized cooperative learning strategies such as group problem-solving, shared discussions, and collaborative tasks. These approaches were particularly beneficial in multigrade classrooms, where peer interaction can support differentiated learning and maximize instructional time by allowing students to learn from one another.

Furthermore, the consistent use of cooperative learning highlights its role in creating an inclusive and participatory classroom environment. By engaging students in collaborative activities, teachers not only improve academic outcomes but also develop essential social and communication skills.

The results presented in Table 5 indicated a robust level of implementation of manipulative-based instructional strategies in multigrade mathematics classes, as evidenced by the overall weighted mean of 4.61 (SD = 0.57), interpreted as Always. This suggested that teachers regularly integrated concrete and hands-on materials to enhance students' understanding of mathematical concepts, which was particularly essential in addressing the diverse needs of learners in multigrade settings.

Among the indicators, the highest mean was obtained by the statements "My teacher lets us explore mathematical ideas through hands-on activities" and "My teacher encourages me to demonstrate my solutions using manipulatives" (both M = 4.66, SD = 0.56 and 0.72, respectively).

Table 5. Level of Teachers' Strategies used in Multigrade Classes in terms of Manipulative-Based Instruction

STATEMENTS	MEAN	SD	REMARKS
My teacher uses concrete materials (e.g., blocks, counters) to teach mathematical concepts.	4.58	0.86	Always
My teacher lets us explore mathematical ideas through hands-on activities.	4.66	0.56	Always
My teacher relates the use of manipulatives to abstract mathematical symbols or equations.	4.53	0.75	Always
My teacher encourages me to demonstrate my solutions using manipulatives.	4.66	0.72	Always
My teacher regularly integrates manipulatives in our mathematics lessons.	4.62	0.71	Always
Weighted Mean			4.61
SD			0.57
Verbal Interpretation			Very High

This indicated that experiential and active learning approaches are strongly emphasized, allowing students to engage directly with mathematical concepts. Such practices facilitate deeper conceptual understanding and enable learners to construct meaning through exploration and demonstration.

In contrast, the lowest mean, although still interpreted as Always, was recorded in the statement "My teacher relates the use of manipulatives to abstract mathematical symbols or equations" (M = 4.53, SD = 0.75). This implied that while manipulatives were widely utilized, the explicit connection between concrete experiences and abstract representations is relatively less emphasized. This transition is a critical component of mathematics learning, as it supports the development of higher-order thinking and symbolic reasoning.

Overall, the findings revealed that manipulative-based instruction was a well-established pedagogical practice in multigrade mathematics classrooms. Teachers effectively employ strategies that promote hands-on engagement, student demonstration, and active participation, which were essential in fostering meaningful learning experiences among students with varying levels of readiness.

Furthermore, the evident integration of manipulative-based strategies highlights their role in bridging the gap between concrete experiences and abstract mathematical thinking. By engaging students in active learning processes, teachers were able to enhance conceptual clarity, strengthen problem-solving skills, and improve overall mathematical proficiency.

The results presented in Table 6 revealed a very high level of behavioral engagement among learners in multigrade mathematics classes, as evidenced by the overall weighted mean of 4.58 (SD = 0.53). This indicated that students were highly involved in classroom activities, consistently attentive during lessons, and actively participated in various learning tasks.

Among the indicators, the highest mean was obtained by the statement "I pay attention during math lessons and activities" (M = 4.67, SD = 0.59), suggesting that learners demonstrate strong focus and sustained attention during instruction. This reflected their interest in the subject and their responsiveness to classroom activities, which were essential for effective learning.

Table 6. Level of Learners' Engagement in terms of Behavioral Engagement

STATEMENTS	MEAN	SD	REMARKS
I actively participate in mathematics class discussions.	4.58	0.78	Always
I complete my mathematics assignments on time.	4.52	0.68	Always
I pay attention during math lessons and activities.	4.67	0.59	Always
I follow classroom rules and instructions during math classes.	4.60	0.78	Always
I participate in math-related group work and projects.	4.58	0.77	Always
Weighted Mean			4.58
SD			0.53
Verbal Interpretation			Very High

Conversely, the lowest mean was recorded in the statement "I complete my mathematics assignments on time" (M = 4.52, SD = 0.68). Although slightly lower relative to the other indicators, this still indicated that students generally exhibit responsible academic behavior, with minor variations in consistently meeting deadlines. Such differences may be influenced by individual learning pace, task complexity, or external factors affecting students' time management.

Overall, the findings indicated that learners demonstrated active participation, attentiveness, adherence to classroom expectations, and involvement in collaborative activities, all of which were key indicators of strong behavioral engagement in mathematics learning.

Furthermore, the high degree of behavioral engagement may be associated with the effective use of varied teaching strategies that encourage participation, interaction, and sustained attention among learners.

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The findings highlight the importance of sustaining instructional practices that promote active participation and attentiveness. Teachers could further enhance engagement by strengthening strategies that support students' time management and task completion, ensuring consistent involvement in all aspects of mathematics learning.

The results presented in Table 7 revealed a very high level of cognitive engagement among learners in multigrade mathematics classes, as reflected by the overall weighted mean of 4.59 (SD = 0.53). This indicated that students invested effort in understanding mathematical concepts and critical thinking.

Among the indicators, the highest mean was obtained by the statement "I try to understand the logic behind every math problem" (M = 4.65, SD = 0.74). This suggested that learners demonstrate a strong inclination toward deep learning, focusing not only on arriving at correct answers but also on comprehending underlying principles and reasoning. Such behavior reflected higher-order thinking, which is essential for mastery in mathematics.

Table 7. Level of Learners' Engagement in terms of Cognitive Engagement

STATEMENTS	MEAN	SD	REMARKS
I try to understand the logic behind every math problem.	4.65	0.74	Always
I look for different ways to solve mathematical problems.	4.54	0.73	Always
I apply mathematical concepts to real-life situations.	4.45	0.83	Always
I reflect on how I learn mathematics.	4.56	0.76	Always
I ask questions when I don't understand a math lesson.	4.62	0.73	Always
Weighted Mean			4.59
SD			0.53
Verbal Interpretation			Very High

In contrast, the lowest mean was recorded in the statement "I apply mathematical concepts to real-life situations" (M = 4.45, SD = 0.83). While still indicative of strong engagement, this finding suggested that the application of mathematical knowledge to real-world contexts is relatively less emphasized among learners. This may point to a need for more contextualized learning experiences that bridge theoretical concepts and practical applications.

Overall, the findings indicated that learners exhibited analytical thinking, problem-solving flexibility, self-reflection, and inquiry-based behaviors, all of which were key components of cognitive engagement. These practices support deeper understanding and long-term retention of mathematical knowledge.

Furthermore, the strong cognitive engagement of learners may be influenced by the implementation of effective teaching strategies that encourage critical thinking, exploration, and active participation in mathematical tasks.

The findings highlight the importance of strengthening instructional approaches that promote the application of mathematical concepts to real-life situations. Teachers could enhance cognitive engagement by integrating contextualized problems, real-world scenarios, and reflective activities that deepen students' understanding and relevance of mathematics.

The results presented in Table 8 revealed a very high level of affective engagement among learners, as indicated by the overall weighted mean of 4.55 (SD = 0.57). This indicated that students possessed positive emotions toward mathematics, demonstrated confidence in their abilities, and maintained a strong sense of motivation in the learning process.

Table 8. Level of Learners' Engagement in terms of Affective Engagement

STATEMENTS	MEAN	SD	REMARKS
I enjoy learning mathematics.	4.61	0.71	Always
I feel confident in my ability to learn mathematics.	4.56	0.75	Always
I feel proud when I solve difficult math problems.	4.54	0.65	Always
I feel comfortable expressing my ideas in math class.	4.48	0.74	Always
I feel positive and motivated during math activities.	4.55	0.81	Always
Weighted Mean			4.55
SD			0.57
Verbal Interpretation			Very High

Among the indicators, the highest mean was obtained by the statement "I enjoy learning mathematics" (M = 4.61, SD = 0.71). This indicated that learners generally had a favorable disposition toward the subject, which played a crucial role in sustaining interest and promoting continued engagement in mathematical tasks. Enjoyment in learning is often associated with increased participation and persistence.

In contrast, the lowest mean was recorded in the statement "I feel comfortable expressing my ideas in math class" (M = 4.48, SD = 0.74). Although still reflective of strong affective engagement, this suggested that some learners may experience slight hesitation in sharing their thoughts or ideas during mathematics discussions. This may be influenced by factors such as confidence levels, classroom dynamics, or fear of making mistakes.

Overall, the findings indicated that learners exhibited positive attitudes, confidence, motivation, and emotional investment in mathematics learning. These affective components were essential in shaping students' willingness to engage, persist in challenging tasks, and develop a deeper appreciation for the subject.

Furthermore, the strong affective engagement observed may be linked to the use of supportive and interactive teaching strategies that foster a positive and encouraging classroom environment.

The findings underscored the importance of maintaining a supportive classroom atmosphere that encourages students to express their ideas confidently. Teachers could further enhance affective engagement by promoting a safe learning environment, providing positive reinforcement, and incorporating activities that build students' confidence and motivation in mathematics.

The results presented in Table 9 revealed a very high level of social engagement among learners in multigrade mathematics classes, as evidenced by the overall weighted mean of 4.61 (SD = 0.54). This indicated that students actively interacted with their peers, participated in collaborative activities, and demonstrated positive interpersonal behaviors during mathematics learning.

Table 9. Level of Learners' Engagement in terms of Social Engagement

STATEMENTS	MEAN	SD	REMARKS
I enjoy working with classmates during math activities.	4.75	0.63	Always
I help my classmates when they have difficulty in math.	4.51	0.80	Always
I share my ideas and listen to others during group discussions.	4.53	0.80	Always
I feel comfortable collaborating with others in solving math problems.	4.63	0.68	Always
I show respect for the opinions and answers of my classmates.	4.61	0.67	Always
Weighted Mean			4.61
SD			0.54
Verbal Interpretation			Very High

Among the indicators, the highest mean was obtained by the statement "I enjoy working with classmates during math activities" (M = 4.75, SD = 0.63). This suggested that learners have a strong preference for collaborative learning, reflecting a positive attitude toward group work and shared problem-solving experiences. Such enjoyment enhances participation and fostered a supportive learning environment.

In contrast, the lowest mean was recorded in the statement "I help my classmates when they have difficulty in math" (M = 4.51, SD = 0.80). While still indicative of strong engagement, this suggested that peer assistance, although present, may be slightly less consistently demonstrated compared to other social behaviors. This may be influenced by differences in confidence levels, understanding of the content, or willingness to take on supportive roles.

Overall, the findings indicated that learners demonstrated collaboration, mutual respect, active participation in group discussions, and positive peer interaction, all of which were essential components of social engagement in mathematics learning. These behaviors contributed to a cooperative classroom environment that supports both academic and social development.

Furthermore, the high level of social engagement may be attributed to the use of interactive teaching strategies such as cooperative learning and peer tutoring, which encourage students to work together, share ideas, and support one another's learning.

The findings highlight the importance of sustaining collaborative learning environments that promote peer interaction and mutual support. Teachers could further enhance social engagement by strengthening structured peer assistance strategies and encouraging all learners to actively contribute to group learning processes.

The results presented in Table 10 revealed a very high level of learners' mathematical abilities in terms of conceptual understanding, as reflected by the overall weighted mean of 4.48 (SD = 0.71). This indicated that students possessed a strong grasp of mathematical concepts.

Among the indicators, the highest mean was obtained by the statement "I understand the meaning behind mathematical formulas and symbols" (M = 4.54, SD = 0.75). This suggested that learners demonstrated a deep level of comprehension, particularly in interpreting the underlying meaning of mathematical representations. Such understanding is essential in developing flexible thinking and the ability to apply knowledge in various contexts.

Table 10. Level of Learners' Mathematical Abilities in terms of Conceptual Understanding

STATEMENTS	MEAN	SD	REMARKS
I can explain mathematical concepts in my own words.	4.52	0.80	Always
I understand the relationship between different math ideas.	4.45	0.86	Always
I can identify which math concept applies to a given problem.	4.37	0.98	Always
I can connect new math lessons to what I have previously learned.	4.51	0.88	Always
I understand the meaning behind mathematical formulas and symbols.	4.54	0.75	Always
Weighted Mean			4.48
SD			0.71
Verbal Interpretation			Very High

In contrast, the lowest mean was recorded in the statement "I can identify which math concept applies to a given problem" (M = 4.37, SD = 0.98). While still indicative of strong conceptual ability, this finding suggested that some learners may experience slight difficulty in selecting the most appropriate concept when solving problems. This may be attributed to challenges in transferring knowledge across different problem situations or recognizing problem structures.

Overall, the findings indicated that learners demonstrated the ability to explain concepts, establish connections among ideas, and relate prior knowledge to new learning, which were key indicators of conceptual understanding in mathematics. These competencies supported meaningful learning and enable students to approach mathematical problems with greater insight and flexibility.

Furthermore, the strong conceptual understanding of learners may be associated with the use of instructional strategies that emphasize meaning-making, exploration, and active engagement, allowing students to construct knowledge rather than rely solely on memorization.

The results presented in Table 11 revealed a very high level of learners' mathematical abilities in terms of mathematical fluency, as evidenced by the overall weighted mean of 4.38 (SD = 0.77). This indicated that learners were generally proficient in performing mathematical operations with accuracy, efficiency, and appropriate speed.

Among the indicators, the highest mean was obtained by the statement "I can estimate answers and check for reasonableness" (M = 4.51, SD = 0.84). This suggested that learners were capable of evaluating the validity of their solutions, reflecting not only computational skill but also critical thinking and self-monitoring in problem-solving processes.

In contrast, the lowest mean was recorded in the statement "I can simplify mathematical expressions efficiently" (M = 4.30, SD = 0.99). Although still indicative of strong fluency, this finding suggested that some learners may encounter slight difficulty in efficiently manipulating mathematical expressions, which may require deeper familiarity with rules and consistent practice.

Table 11. Level of Learners' Mathematical Abilities in terms of Mathematical Fluency

STATEMENTS	MEAN	SD	REMARKS
I can perform basic arithmetic operations accurately and quickly.	4.43	0.84	Always
I can recall mathematical formulas and rules easily.	4.34	0.87	Always
I can use mathematical operations automatically without much effort.	4.32	0.95	Always
I can estimate answers and check for reasonableness.	4.51	0.84	Always
I can simplify mathematical expressions efficiently.	4.30	0.99	Always
Weighted Mean			4.38
SD			0.77
Verbal Interpretation			Very High

Overall, the findings indicated that learners demonstrate accuracy in computation, ease in recalling mathematical rules, and the ability to perform operations with minimal effort, which were key components of mathematical fluency. These skills were essential for solving problems efficiently and for supporting higher-level mathematical thinking.

Furthermore, the strong level of mathematical fluency may be attributed to instructional practices that provide repeated exposure, guided practice, and opportunities for application, enabling learners to develop automaticity and confidence in performing mathematical tasks.

The findings highlighted the need to further enhance learners' efficiency in simplifying mathematical expressions and applying procedures flexibly. Teachers could strengthen mathematical fluency by incorporating varied practice activities, problem-solving tasks, and opportunities for students to explain their processes, thereby reinforcing both speed and understanding.

The results presented in Table 12 revealed a very high level of learners' mathematical abilities in terms of critical thinking, as reflected by the overall weighted mean of 4.49 (SD = 0.70). This indicated that learners were able to engage in higher-order thinking processes such as analysis, evaluation, and reasoning when dealing with mathematical problems.

Table 12. Level of Learners' Mathematical Abilities in terms of Critical Thinking Ability

STATEMENTS	MEAN	SD	REMARKS
I can analyze mathematical problems carefully before solving them.	4.63	0.77	Always
I can justify my solutions using logical reasoning.	4.42	0.89	Always
I can identify errors in mathematical solutions or reasoning.	4.38	0.85	Always
I can evaluate different methods and choose the best one.	4.54	0.78	Always
I can draw conclusions based on mathematical evidence.	4.50	0.82	Always
Weighted Mean			4.49
SD			0.70
Verbal Interpretation			Very High

Among the indicators, the highest mean was obtained by the statement "I can analyze mathematical problems carefully before solving them" (M = 4.63, SD = 0.77). This suggested that learners demonstrate strong analytical skills, taking time to examine problem structures and requirements prior to arriving at solutions. Such behavior is essential in promoting accuracy and deeper understanding in mathematics.

In contrast, the lowest mean was recorded in the statement "I can identify errors in mathematical solutions or reasoning" (M = 4.38, SD = 0.85). While still indicative of strong critical thinking ability, this finding suggested that some learners may experience slight difficulty in detecting inaccuracies or misconceptions in solutions. This skill requires a high level of metacognitive awareness and careful evaluation, which may need further development.

Overall, the findings indicated that learners demonstrated the ability to analyze problems, justify solutions, evaluate alternative methods, and draw evidence-based conclusions, which were key components of critical thinking in mathematics. These competencies enable learners to approach mathematical tasks with depth, accuracy, and logical reasoning.

The findings highlighted the need to further strengthen learners' ability to identify errors and evaluate reasoning in mathematical solutions. Teachers could enhance this skill by incorporating activities such as error analysis, peer evaluation, and reflective problem-solving tasks that encourage deeper examination of mathematical processes.

The results presented in Table 13 indicated that all teaching strategies were significantly related to the different dimensions of learners' mathematical engagement, as evidenced by p-values less than .001. This showed that the relationships observed were statistically significant and unlikely to have occurred by chance.

The correlation coefficients further revealed that the relationships between teaching strategies and mathematical engagement ranged from moderate to strong positive associations. Specifically, differentiated instruction, scaffolded instruction, peer tutoring, cooperative learning, and manipulative-based instruction all demonstrate meaningful relationships with behavioral, cognitive, affective, and social engagement.

These positive correlations indicated that as the level of teaching strategies increased, learners' engagement across all dimensions also tended to increase. The consistent pattern across all variables suggested that varied instructional approaches were closely linked to students' active participation, cognitive involvement, emotional investment, and social interaction in mathematics learning.

Overall, the findings highlighted that the use of diverse teaching strategies was closely associated with enhanced learner engagement in multigrade mathematics classes.

The results suggested that teachers should continue to employ a variety of instructional strategies to sustain and strengthen students' engagement across behavioral, cognitive, affective, and social domains.

Table 13. Teachers' Strategies Used in Multigrade Classes and Level of Learners' Engagement

Teachers' Strategies in Multigrade Classes	Learners' Engagement			
	Behavioral	Cognitive	Affective	Social
Differentiated: Pearson Correlation	0.64***	0.65***	0.63***	0.67***
Instruction Significance(2-Tailed)	<.001	<.001	<.001	<.001
N	116	116	116	116
Scaffold: Pearson Correlation	0.53***	0.55***	0.52***	0.49***
Instruction Significance(2-Tailed)	<.001	<.001	<.001	<.001
N	116	116	116	116
Peer tutoring Pearson Correlation	0.59***	0.54***	0.60***	0.54***
Significance(2-Tailed)	<.001	<.001	<.001	<.001
N	116	116	116	116
Cooperative: Pearson Correlation	0.64***	0.65***	0.71***	0.72***
Learning Significance(2-Tailed)	<.001	<.001	<.001	<.001
N	116	116	116	116
Manipulative: Pearson Correlation	0.65***	0.60***	0.65***	0.58***
– based instruction	<.001	<.001	<.001	<.001
Significance(2-Tailed)	116	116	116	116
N				

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

This finding was supported by the study of Utami et al. (2025), which emphasized that student engagement was influenced by classroom practices that promote active participation, interaction, and meaningful learning experiences. Instructional strategies that were responsive and interactive were more likely to foster multiple dimensions of engagement.

The results presented in Table 14 indicated that all teaching strategies were significantly related to learners' mathematical abilities, as evidenced by p-values less than .001. This showed that the relationships observed between instructional practices and mathematical abilities are statistically significant.

Table 14. Teachers' Strategies Used in Multigrade Classes and Level of Learners' Mathematical Abilities

Teachers' Strategies in Multigrade Classes	Learners' Mathematical Abilities		
	Conceptual Understanding	Mathematical Fluency	Critical Thinking Ability
Differentiated: Pearson Correlation	0.63***	0.61***	0.56***
Instruction Significance(2-Tailed)	<.001	<.001	<.001
N	116	116	116
Scaffold: Pearson Correlation	0.51***	0.54***	0.46***
Instruction Significance(2-Tailed)	<.001	<.001	<.001
N	116	116	116
Peer tutoring: Pearson Correlation	0.53***	0.53***	0.54***
Significance(2-Tailed)	<.001	<.001	<.001
N	116	116	116
Cooperative: Pearson Correlation	0.60***	0.57***	0.60***
Learning Significance(2-Tailed)	<.001	<.001	<.001
N	116	116	116
Manipulative: Pearson Correlation	0.52***	0.56***	0.49***
– based instruction	<.001	<.001	<.001
Significance(2-Tailed)	116	116	116
N			

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

The correlation coefficients further revealed that the relationships between teaching strategies and mathematical abilities ranged from moderate to strong positive associations. Specifically, differentiated instruction, scaffolded instruction, peer tutoring, cooperative learning, and manipulative-based instruction all demonstrate meaningful relationships with conceptual understanding, mathematical fluency, and critical thinking ability.

These positive correlations indicated that higher levels of implementation of teaching strategies were associated with higher levels of learners' mathematical abilities. The consistent pattern across all variables suggested that the use of varied instructional approaches is closely linked to learners' ability to understand concepts, perform mathematical operations efficiently, and engage in critical thinking processes.

Overall, the findings highlighted that diverse teaching strategies are closely associated with enhanced mathematical abilities among learners in multigrade mathematics classes.

This finding was supported by the study of Go et al. (2023), which emphasized that effective mathematics instruction plays a crucial role in developing conceptual understanding, procedural fluency, and strategic competence. Instructional practices that actively engage learners contribute to the development of these essential mathematical abilities.

IV. Conclusion and Recommendations

A significant relationship was observed between teaching strategies and learners' engagement across the dimensions, leading to the rejection of the null hypothesis. This means that the instructional strategies employed by teachers in multigrade mathematics classes have a direct and meaningful association on learners' engagement.

A significant relationship was also observed between teaching strategies and learners' mathematical abilities. This meant that effective and diverse teaching strategies are associated to the development of learners' mathematical competence.

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

School heads may strengthen instructional support systems by promoting differentiated instruction, collaborative learning practices, structured scaffolding, contextualized teaching strategies, and professional development initiatives that enhance learners' mathematical understanding and higher-order thinking skills.

Teachers may further enhance mathematics instruction by strengthening differentiated feedback, structured scaffolding, collaborative learning, real-life conceptual connections, and metacognitive skill development to improve learners' understanding, independence, and problem-solving abilities.

Learners may improve their mathematical understanding and problem-solving abilities by actively participating in collaborative activities, engaging in reflective and independent learning tasks, applying mathematical concepts to real-life situations, and developing stronger metacognitive and evaluative skills.

Future researchers may extend the investigation of instructional practices by exploring additional variables.

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