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Numeracy and Literacy Integration of Mathematics Teachers and the Learners' Motivation, Engagement and Conceptual Understanding of Elementary Learners

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Abstract*—This study aimed to determine the numeracy and literacy integration of mathematics teachers and the learners' motivation, engagement, and conceptual understanding of elementary learners. Specifically, it examined the perspectives of mathematics teachers regarding the integration of numeracy and literacy in mathematics subject. Furthermore, it determined the significant relationships between numeracy and literacy integration and the learner's motivation, engagement, and conceptual understanding. A quantitative approach was used to conduct this study, utilizing a descriptive-correlational approach to determine patterns and relationships. Data were gathered through a self-made survey questionnaire administered to 107 elementary mathematics teachers from the Pila Sub-Office. Respondents were selected using purposive sampling techniques to ensure relevant and representative participation. Statistical tools such as mean, standard deviation, and correlation coefficient were used to analyze the data. Findings revealed that the integration of numeracy and literacy in mathematics is highly integrated in learner's motivation; engagement; and conceptual understanding. A significant relationship was also found between the integration of numeracy and literacy and learners' motivation, engagement, and conceptual understanding; this led to the rejection of the null hypothesis. This means that the more effectively teachers integrate literacy into numeracy instruction, the more positively it influences learners' motivation, engagement, and conceptual understanding, enhancing their overall learning experience. Based on these findings, it is recommended that teachers continue using interdisciplinary strategies to foster student engagement and understanding. Additionally, schools may offer continuous professional development opportunities to help educators enhance their skills in effectively integrating literacy into mathematics instruction.*

I. INTRODUCTION

Mathematics teachers play a key role in integrating numeracy and literacy in their classrooms. Their approach influences how they plan lessons, create strategies, and engage students. Moving away from traditional teaching methods, teachers are encouraged to include reading, writing, and discussions in math lessons. This approach helps students connect math concepts to real-world situations, improving their understanding and motivation to tackle more complex topics.

Conceptual understanding, student motivation and engagement are essential factors for academic success, particularly in subjects like mathematics, which many students find challenging. The integration of literacy into mathematics helps increase motivation by making the material more relatable and easier to understand, as students connect mathematical concepts with real-world scenarios.

Thus, integrating numeracy and literacy in elementary math education is a promising strategy for improving students' understanding, motivation, and engagement. Researcher suggests that focusing on both numeracy and literacy equips students with the skills they need for academic success and real-world problem-solving.

1.1 Statement of the Problem

Problem/s which were addressed by the research

This study aimed to determine the numeracy and literacy integration of mathematics teachers and the learners' motivation, engagement, and conceptual understanding of elementary learners.

Specifically, it sought to answer the following questions:

1. What is the extent of numeracy and literacy integration according to the mathematics teachers' perspectives in terms of the following:
   1.1 Teaching Strategy
   1.2 Cross Subject Integration
   1.3 Appropriate Activity
   1.4 Complexity of Materials
   1.5 Learning Pathways
2. What is the level of learners' motivation in terms of
   2.1 Class Participation
   2.2 Peer Collaboration
   2.3 Task Completion
3. What is the level of learners' engagement in terms of:
   3.1 Cognitive
   3.2 Physical
   3.3 Behavioral
4. What is the level of learners' conceptual understanding in terms of
   4.1 Transfer of Learning
   4.2 Logical Reasoning
   4.3 Ability To Take Influence
   4.4 Flexibility
5. Is there a significant relationship between the numeracy and literacy integration of mathematics teachers and the learners' motivation?

Katherine V. Vicente, "Numeracy and Literacy Integration of Mathematics Teachers and the Learners' Motivation, Engagement and Conceptual Understanding of Elementary Learners," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 7, Issue 12, pp. 409-419, 2025.

6. Is there a significant relationship between the numeracy and literacy integration of mathematics teachers and the learners' engagement?
7. Is there a significant relationship between the numeracy and literacy integration of mathematics teachers and the learners' conceptual understanding?

II. METHODOLOGY

A quantitative approach was used to conduct this study, utilizing a descriptive-correlational approach to determine patterns and relationships. Data were gathered through a self-made survey questionnaire administered to 107 elementary mathematics teachers from the Pila Sub-Office. Respondents were selected using purposive sampling techniques to ensure relevant and representative participation. Statistical tools such as mean, standard deviation, and correlation coefficient were used to analyze the data.

III. RESULTS AND DISCUSSION

This chapter deals with the presentation, analysis, and interpretation form the data gathered that showed a significant relationship between the teachers' integration of numeracy and literacy and the learners' motivation, the learners' engagement, and the learners' conceptual understanding.

Integration of Numeracy and Literacy

In this study, the integration of literacy and numeracy implies a method in which language and mathematical abilities are combined during the learning process. This integration focused on how teachers integrated literary elements into math lessons, including vocabulary development, writing skills, and reading comprehension. It also looked at how literacy-related activities incorporated numeracy abilities including number sense, mathematical problem-solving, and fundamental arithmetic. By bridging the gap between these two crucial areas of education, the aim was to improve students' learning.

The study explored a few variables that affected how much numeracy and literacy were integrated in the classroom. These elements included the methods that math teachers used to teach, the degree of cross-subject integration, the suitability of the activities created to facilitate this integration, and the complexity of the teaching resources. To find out how they affected students' learning outcomes, learning pathways, which are the various strategies and teaching techniques that help students become proficient in both numeracy and literacy were also investigated.

The extent of integration of numeracy and literacy according to the mathematics teacher's perspectives in terms of teaching strategy, cross subject integration, appropriate activity, complexity of materials and learning pathways, was treated statistically using mean and standard deviation.

Table 1 shows the extent of integration of numeracy and literacy according to the mathematics teacher's perspectives in terms of teaching strategy. In addition, it provides the mean, standard deviation, comments, and statements.

Mathematics teachers implement various strategies to foster numeracy and literacy integration, focusing on mathematical discussions, student collaboration, and justification of solutions. The mean (M = 4.76) indicates a high level of integration when designing lessons that encourage students to explain their mathematical thinking through language. Meanwhile, the mean is slightly lower (M = 4.69) for assessing students' understanding by encouraging them to explain and justify their solutions, yet it still indicates strong commitment to integrating numeracy and literacy.

TABLE 1. The Extent of Numeracy and Literacy Integration according to the Mathematics Teacher's Perspectives in Terms of Teaching Strategy

STATEMENT	**MEAN**	**SD**	**REMARKS**
I design lessons that allow students to examine their mathematical thinking through language.	4.76	0.43	Strongly Agree
I use discussion-based activities to help students interpret mathematical concepts.	4.75	0.46	Strongly Agree
I encourage students to break down and explain their mathematical thinking during class.	4.75	0.44	Strongly Agree
I provide opportunities for students to explore and collaborate on numeracy-based tasks.	4.71	0.46	Strongly Agree
I assess students' understanding by encouraging them to justify their solutions with reasoning.	4.69	0.46	Strongly Agree
Weighted Mean	*4.73*		
SD	*0.45*		
Verbal Interpretation	*Highly Integrated*		

The extent of integration of numeracy and literacy according to the mathematics teacher's perspectives in terms of teaching strategy attained a weighted mean score of 4.73 and a standard deviation of 0.45 and was verbally interpreted as highly integrated.

In summary, mathematics teachers actively foster numeracy and literacy integration by designing discussion-based activities, encouraging oral explanations, and assessing students' reasoning through justification of mathematical solutions.

According to Kazemi, E. & Stipek, D. (2022), effective teaching methods, such as active learning, collaborative activities, and differentiated instruction, can significantly enhance student engagement and class participation. Active learning strategies, like group discussions, problem-solving activities, and hands-on experiments, encourage students to take an active role in their education. This engagement not only promotes deeper understanding but also allows students to express their thoughts and ideas more freely, which can lead to increased participation.

Table 2 shows the extent of integration of numeracy and literacy according to the mathematics teacher's perspectives in terms of cross-subject integration. Additionally, it lists the remarks, mean, standard deviation, and statements.

Mathematics teachers employ interdisciplinary approaches to enhance engagement and problem-solving abilities. The mean (M = 4.79) indicates a high level of integration when encouraging students to apply literacy skills in solving numerical problems. Meanwhile, the mean is slightly lower (M = 4.50) for incorporating cross-subject activities consistently, yet it still indicates a strong level of integration.

Katherine V. Vicente, "Numeracy and Literacy Integration of Mathematics Teachers and the Learners' Motivation, Engagement and Conceptual Understanding of Elementary Learners," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 7, Issue 12, pp. 409-419, 2025.

TABLE 2. The Extent of Numeracy and Literacy Integration according to the Mathematics Teacher's Perspectives in terms of Cross Subject Integration

STATEMENT	MEAN	SD	REMARKS
I apply cross-subject integration to enhance engagement and deepen understanding in my lessons.	4.70	0.46	Strongly Agree
I incorporate stories or real-world scenarios to apply literacy skills in problem-solving tasks.	4.73	0.45	Strongly Agree
I implement cross-subject activities as a consistent part of my teaching strategy.	4.50	0.54	Strongly Agree
I develop lessons that apply both literacy and numeracy skills to enhance student learning.	4.73	0.45	Strongly Agree
I encourage students to use literacy skills (e.g., reading comprehension, writing) to apply them in solving numerical problems.	4.79	0.41	Strongly Agree
Weighted Mean	*4.69*		
SD	*0.46*		
Verbal Interpretation	*Highly Integrated*		

The extent of integration of numeracy and literacy according to the mathematics teacher's perspectives in terms of cross-subject integration attained a weighted mean score of 4.69 and a standard deviation of 0.46 and was verbally interpreted as highly integrated.

In summary, mathematics teachers successfully integrate literacy and numeracy across subjects by designing interdisciplinary lessons, using real-world scenarios, and encouraging students to apply reading and writing skills in problem-solving tasks.

Students are better able to retain and apply knowledge when various courses are bridged, which improves learning outcomes. In addition to assisting with topic mastery, this integration promotes a more thorough comprehension of the connections between various disciplines. Additionally, it pushes students to consider learning and its real-world implications from a more comprehensive perspective.

TABLE 3. The Extent of Numeracy and Literacy Integration according to the Mathematics Teacher's Perspectives in Terms of Appropriate Activity

STATEMENT	MEAN	SD	REMARKS
I evaluate the effectiveness of using mathematical puzzles or games with written instructions in blending reading comprehension with problem-solving.	4.61	0.49	Strongly Agree
I assess the appropriateness of activities that require students to write reflections on how they solved a problem in integrating literacy and numeracy.	4.57	0.57	Strongly Agree
I determine the effectiveness of creating cross-subject projects (e.g., a science experiment requiring calculations and written explanations).	4.61	0.55	Strongly Agree
I analyze the value of using real-world tasks (e.g., budgeting, creating schedules) in integrating literacy and numeracy skills.	4.70	0.50	Strongly Agree
I assess the impact of group discussions that require both critical thinking and clear verbal explanations in supporting literacy and numeracy integration.	4.70	0.48	Strongly Agree
Weighted Mean	*4.64*		
SD	*0.52*		
Verbal Interpretation	*Highly Integrated*		

Table 3 shows the extent of integration of numeracy and literacy according to the mathematics teacher's perspectives in terms of appropriate activity. It also presents the statements, mean, standard deviation, and remarks.

Mathematics teachers utilize various learning activities that promote both numeracy and literacy skills. The mean (M = 4.70) indicates a high level of integration in using real-world tasks like budgeting and scheduling to combine literacy and numeracy. Meanwhile, the mean is slightly lower (M = 4.57) for activities requiring students to write reflections on problem-solving, yet it still supports effective integration.

The extent of integration of numeracy and literacy according to the mathematics teacher's perspectives in terms of appropriate activity attained a weighted mean score of 4.64 and a standard deviation of 0.52 and was verbally interpreted as highly integrated.

In summary, mathematics teachers integrate appropriate activities that enhance students' problem-solving, communication, and critical thinking skills through engaging and meaningful learning tasks.

According to cognitive research, the most accurate predictors of how well a student will apply their knowledge are the structure of their learning and how it connects to their existing knowledge (National Research Council, 2020).

TABLE 4. The Extent of Numeracy and Literacy Integration according to the Mathematics Teacher's Perspectives in Terms of Complexity of Materials

STATEMENT	MEAN	SD	REMARKS
I create literacy-based math tasks that promote higher-order thinking.	4.57	0.55	Strongly Agree
I modify the complexity of tasks based on student readiness in both literacy and numeracy.	4.63	0.51	Strongly Agree
I design word problems with varying difficulty levels to match students' literacy and numeracy skills.	4.61	0.56	Strongly Agree
I develop literacy-numeracy materials that encourage students to think critically and solve problems.	4.64	0.50	Strongly Agree
I select and adapt materials that challenge students' abilities in both mathematical reasoning and reading comprehension.	4.59	0.60	Strongly Agree
Weighted Mean	*4.61*		
SD	*0.54*		
Verbal Interpretation	*Highly Integrated*		

Table 4 shows the extent of integration of numeracy and literacy according to the mathematics teacher's perspectives in terms of complexity of materials. It also presents the statements, mean, standard deviation, and remarks.

Mathematics teachers ensure that literacy-based math tasks challenge students and promote higher-order thinking. The mean (M = 4.64) indicates a high level of integration when using materials that encourage students to think critically and solve problems. Meanwhile, the mean is slightly lower (M = 4.57) in ensuring that literacy-based math tasks promote higher-order thinking, yet it still indicates strong engagement with complex learning materials.

The extent of integration of numeracy and literacy according to the mathematics teacher's perspectives in terms of complexity of materials attained a weighted mean score of 4.61 and a standard deviation of 0.54 and was verbally interpreted as highly integrated.

Katherine V. Vicente, "Numeracy and Literacy Integration of Mathematics Teachers and the Learners' Motivation, Engagement and Conceptual Understanding of Elementary Learners," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 7, Issue 12, pp. 409-419, 2025.

In summary, mathematics teachers effectively integrate complex literacy-numeracy materials by promoting critical thinking, adjusting task complexity based on student readiness, and designing word problems that enhance both literacy and numeracy skills.

In summary, mathematics teachers utilize well-structured, complex, and thought-provoking materials that challenge students' mathematical reasoning and reading comprehension, ensuring a deeper understanding of integrated literacy-numeracy (Anney, V., 2016), investigated the literacy teaching practices in Tanzanian classrooms in the provision of primary education. It conducted a thorough examination of the reasons why primary school graduates lack literacy, writing, and numerical proficiency. One of the goals of this research was to identify challenges related to the instruction and acquisition of literacy skills in Tanzanian elementary school classrooms. The study findings indicated that most of the teachers do not have adequate skills of teaching it. In addition, factors that contributed to illiteracy were pupils' late enrolment in standard one, shortages of teaching and learning resources, and parents' level of education, inadequate literacy teachers and teachers with poor literacy teaching skills.

TABLE 5. The Extent of Numeracy and Literacy Integration according to the Mathematics Teacher's Perspectives in Terms of Learning Pathways

STATEMENT	**MEAN**	**SD**	**REMARKS**
I scaffold literacy and numeracy tasks to help students understand concepts progressively.	4.63	0.51	Strongly Agree
My lessons support students in understanding how to advance from simple to more complex literacy-numeracy tasks.	4.64	0.50	Strongly Agree
I provide students with multiple pathways to enhance their understanding of both numeracy and literacy in math.	4.62	0.53	Strongly Agree
I differentiate tasks to accommodate varying literacy and numeracy levels, ensuring all students can develop their understanding at their own pace.	4.63	0.52	Strongly Agree
I encourage students to deepen their understanding by applying different problem-solving strategies that integrate literacy and numeracy skills (e.g., writing reflections, using math journals, interpreting word problems).	4.68	0.51	Strongly Agree
Weighted Mean	*4.64*		
SD	*0.51*		
Verbal Interpretation	*Highly Integrated*		

Table 5 shows the extent of integration of numeracy and literacy according to the mathematics teacher's perspectives in terms of learning pathways. It also presents the statements, mean, standard deviation, and remarks.

Mathematics teachers design lessons that allow students to progress from basic to complex literacy-numeracy tasks. The mean (M = 4.68) indicates a high level of integration in encouraging students to apply different problem-solving strategies that integrate literacy and numeracy skills. Meanwhile, the mean is slightly lower (M = 4.62) for providing students with multiple pathways to engage with both numeracy and literacy in math, yet it still indicates a strong emphasis on structured learning sequences.

The extent of integration of numeracy and literacy according to the mathematics teacher's perspectives in terms of learning pathways attained a weighted mean score of 4.64 and a standard deviation of 0.51 and was verbally interpreted as highly integrated.

In summary, mathematics teachers provide well-structured learning pathways that help students develop literacy and numeracy skills progressively through differentiated instruction and adaptive problem-solving techniques.

The majority of longitudinal data looks at the average level of development, implying that the interactions between a small number of variables are consistent for all learners. Victoria S., Camilla G., and Cahoon, A. (2021), investigates multiple component numeric skills within a preschool population using a person-centered approach (i.e., a latent transition analysis), thus allowing for an investigation of different subgroup learning pathways of mathematical skills over time.

Learner's Motivation

The learners' level of motivation in terms of class participation, peer collaboration and task completion, was treated statistically using mean and standard deviation.

TABLE 6. Learners' Level of Motivation in Terms of Class Participation

STATEMENT	**MEAN**	**SD**	**REMARKS**
I recognize that my students are eager to answer questions and contribute to discussions involving word problems.	4.66	0.51	Strongly Agree
I recall that my students actively participate in class discussions during numeracy and literacy-integrated lessons.	4.65	0.52	Strongly Agree
I observe increased student participation when numeracy tasks involve literacy skills.	4.61	0.55	Strongly Agree
I notice that my students show more enthusiasm for math lessons that involve reading and discussion.	4.54	0.57	Strongly Agree
I recall high levels of participation when students are asked to explain their mathematical thinking through writing or speaking.	4.48	0.59	Strongly Agree
Weighted Mean	*4.59*		
SD	*0.55*		
Verbal Interpretation	*Highly Motivated*		

Table 6 shows the learners' level of motivation in terms of class participation. It also presents the statements, mean, standard deviation, and remarks. Students actively participate in numeracy-literacy-integrated discussions, showing enthusiasm in solving word problems and explaining mathematical reasoning. The mean (M = 4.66) indicates a high level of motivation when students are eager to answer questions and contribute to discussions. Meanwhile, the mean is slightly lower (M = 4.48) for participation when students are asked to explain their mathematical thinking through writing or speaking, yet it still indicates strong engagement.

The learners' level of motivation in terms of class participation attained a weighted mean score of 4.59 and a standard deviation of 0.55 and was verbally interpreted as highly motivated.

In summary, students demonstrate high motivation in participating in literacy-numeracy discussions, particularly

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when given opportunities to explain their reasoning and contribute ideas in class.

From a cognitive perspective, collaboration can promote conceptual understanding as students can share their thinking, consider alternate conceptions and discrepancies, and make sense of various representations or abstractions (Schwartz, 2019).

TABLE 7. Learners' Level of Motivation in Terms of Peer Collaboration

STATEMENT	MEAN	SD	REMARKS
I understand that my students work well together during group tasks that combine literacy and numeracy.	4.62	0.58	Strongly Agree
I recognize that students demonstrate understanding through meaningful discussions with their peers when solving math problems that require reading comprehension.	4.61	0.55	Strongly Agree
I believe that peer collaboration enhances students' understanding in my literacy-numeracy-integrated lessons.	4.64	0.48	Strongly Agree
I acknowledge that my students deepen their understanding by actively sharing ideas and strategies during group activities involving both literacy and numeracy.	4.67	0.53	Strongly Agree
I observe my students strengthening their understanding by helping one another through explaining concepts and problem-solving techniques in both literacy and numeracy.	4.61	0.53	Strongly Agree
Weighted Mean	*4.63*		
SD	*0.53*		
Verbal Interpretation	*Highly Motivated*		

The learners' level of motivation in peer collaboration is shown in Table 7. Additionally, it includes the mean, standard deviation, statements, and observations.

Students engage in meaningful group activities that integrate literacy and numeracy, fostering discussions and shared problem-solving strategies. The mean (M = 4.67) indicates a high level of motivation when students actively share ideas and strategies during group activities. Meanwhile, the mean is slightly lower (M = 4.61) for students engaging in meaningful discussions when solving math problems requiring reading comprehension, yet it still reflects strong collaborative engagement.

The learners' level of motivation in terms of peer collaboration attained a weighted mean score of 4.63 and a standard deviation of 0.53 and was verbally interpreted as highly motivated.

In summary, students show high motivation to collaborate with peers by exchanging ideas, assisting one another, and working together on numeracy-literacy tasks.

Promoting collaboration among students has become an important focus of instruction aligned with mathematics reform efforts (National Council of Teachers of Mathematics (2020).

Table 8 shows the learners' level of motivation in terms of task completion. It also presents the statements, mean, standard deviation, and remarks.

Students demonstrate responsibility and persistence in completing numeracy-literacy tasks, particularly when they involve problem-solving and written explanations. The mean (M = 4.56) indicates a high level of motivation when students take pride in completing tasks that combine reading, writing, and math. Meanwhile, the mean is slightly lower (M = 4.44) for students consistently completing literacy-based math tasks on time, yet it still indicates strong commitment to task completion.

TABLE 8. Learners' Level of Motivation in Terms of Task Completion

STATEMENT	MEAN	SD	REMARKS
I apply strategies to support my students in consistently completing literacy-based math tasks on time.	4.44	0.65	Strongly Agree
I observe that my students can apply their skills to finish math assignments that require them to read and write explanations.	4.53	0.65	Strongly Agree
I understand that students apply greater enthusiasm in completing numeracy tasks when literacy is involved.	4.50	0.68	Strongly Agree
I recognize that my students regularly apply responsibility by submitting their literacy and numeracy-integrated tasks without reminders.	4.45	0.55	Strongly Agree
I notice that students take pride in applying their reading and writing skills in completing math-related tasks.	4.56	0.60	Strongly Agree
Weighted Mean	*4.50*		
SD	*0.63*		
Verbal Interpretation	*Highly Motivated*		

The learners' level of motivation in terms of task completion attained a weighted mean score of 4.50 and a standard deviation of 0.63 and was verbally interpreted as highly motivated.

In summary, students show strong motivation to complete tasks, demonstrating enthusiasm, accountability, and a sense of accomplishment in numeracy-literacy activities.

According to Cheeseman, J. (2015), the effectiveness of teaching strategies significantly influences students' task completion, particularly in mathematics, where understanding foundational concepts is crucial. Effective strategies, such as direct instruction and scaffolding, can enhance students' ability to complete mathematical tasks successfully.

Learner's Engagement

The learners' level of engagement in terms of cognitive, physical and behavioral, was treated statistically using mean and standard deviation.

Table 9 shows the learners' level of engagement in terms of cognitive aspects. It also presents the statements, mean, standard deviation, and remarks.

Students are mentally focused and exhibit effort when solving math problems that require both literacy and numeracy skills. The mean (M = 4.51) indicates a high level of cognitive engagement when students focus on problem-solving tasks requiring integration of numeracy and literacy. Meanwhile, the mean is slightly lower (M = 4.44) for engagement when students are asked to explain their mathematical reasoning through writing or discussion, yet it still reflects strong cognitive involvement.

Katherine V. Vicente, "Numeracy and Literacy Integration of Mathematics Teachers and the Learners' Motivation, Engagement and Conceptual Understanding of Elementary Learners," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 7, Issue 12, pp. 409-419, 2025.

TABLE 9. Learners' Level of Engagement in Terms of Cognitive

STATEMENT	MEAN	SD	REMARKS
I analyze how my students maintain mental focus when solving math problems that require both literacy and numeracy skills.	4.51	0.54	Strongly Agree
I examine how students engage more when asked to explain their mathematical reasoning through writing or discussion.	4.44	0.69	Strongly Agree
I assess the effort my students show when both literacy and numeracy tasks are combined.	4.45	0.59	Strongly Agree
I analyze the levels of concentration during integrated literacy-numeracy activities.	4.46	0.68	Strongly Agree
I evaluate my students' cognitive involvement in lessons that combine reading, writing, and math.	4.49	0.68	Strongly Agree
Weighted Mean	*4.47*		
SD	*0.63*		
Verbal Interpretation	*Highly Engaged*		

The learners' level of engagement in terms of cognitive aspects attained a weighted mean score of 4.47 and a standard deviation of 0.63 and was verbally interpreted as highly engaged.

In summary, students exhibit strong cognitive engagement by concentrating on numeracy-literacy tasks, explaining their reasoning, and demonstrating problem-solving skills.

Perfetto et al. (2018), states that student's comprehension of a problem and his or her ultimate ability to transfer concepts learned previously to the current problem is inextricably linked to his or her ability to properly represent the problem. Embedded within each representation are concepts that the solver deems analogous to the problem being tackled, and he or she will transfer these concepts to arrive at a satisfying solution. A philosophical underpinning of programs that integrate the STEM domains is the learning of concepts in one domain, such as science or technology, will facilitate the learning of concepts in other domains, such as mathematics or engineering. Students who can identify the connection between concepts across domains will likely demonstrate an understanding of the problem. While a superior understanding of a problem is demonstrated by the transfer of concepts, knowledge, or processes without prompting, sometimes the use of prompting is necessary.

The students' degree of physical participation is depicted in Table 10. Additionally, it includes the statements, mean, standard deviation, and comments.

Students actively participate in hands-on numeracy-literacy activities, demonstrating enthusiasm for movement-based learning tasks. The mean (M = 4.66) indicates a high level of physical engagement when students use manipulatives or visual aids to enhance their understanding of tasks. Meanwhile, the mean is slightly lower (M = 4.64) for participation in hands-on activities requiring reading, writing, and problem-solving in math, yet it still indicates strong involvement.

The learners' level of engagement in terms of physical aspects attained a weighted mean score of 4.65 and a standard deviation of 0.52 and was verbally interpreted as highly engaged.

TABLE 10. Learners' Level of Engagement in Terms of Physical

STATEMENT	MEAN	SD	REMARKS
I apply strategies to encourage my students' physical involvement in group work or activities that integrate literacy and numeracy.	4.64	0.52	Strongly Agree
I ensure that my students actively apply their skills in hands-on activities that require reading, writing, and problem-solving in math.	4.64	0.52	Strongly Agree
I observe students applying movement and peer interaction during literacy-numeracy tasks.	4.64	0.52	Strongly Agree
I recognize that my students apply their knowledge while participating in interactive games or activities that blend literacy and numeracy skills.	4.65	0.50	Strongly Agree
I notice my students applying manipulatives or visual aids to enhance their understanding of tasks that involve both reading and math.	4.66	0.55	Strongly Agree
Weighted Mean	*4.65*		
SD	*0.52*		
Verbal Interpretation	*Highly Engaged*		

In summary, students exhibit high physical engagement in numeracy-literacy activities, actively participating in interactive learning experiences that enhance comprehension.

In the classroom, active learning manifests as a method of instruction that engages students in activities such as speaking, listening, reading, writing, discussing, reflecting, hypothesizing, debating the content, problem solving, working in small groups, experimenting, or other activities. These are situations that require the students to apply what they have learned, invoking higher-order thinking abilities (Braun et al., 2017).

TABLE 11. Learners' Level of Engagement in Terms of Behavioral

STATEMENT	MEAN	SD	REMARKS
I evaluate how my students follow instructions and stay on task during lessons that integrate numeracy and literacy.	4.68	0.56	Strongly Agree
I appreciate and assess students' persistence in completing math tasks that involve reading comprehension or written explanations.	4.64	0.62	Strongly Agree
I analyze how students' motivation increases when literacy is incorporated into math tasks.	4.64	0.56	Strongly Agree
I assess my students' enthusiasm and focus during lessons that combine literacy and numeracy activities.	4.58	0.60	Strongly Agree
I evaluate how students readily ask questions and seek clarification when working on tasks that integrate both literacy and numeracy.	4.68	0.49	Strongly Agree
Weighted Mean	*4.64*		
SD	*0.56*		
Verbal Interpretation	*Highly Engaged*		

Table 11 shows the learners' level of engagement in terms of behavioral aspects. It also presents the statements, mean, standard deviation, and remarks.

Students demonstrate discipline, focus, and motivation in numeracy-literacy-integrated lessons. The mean (M = 4.68) indicates a high level of behavioral engagement when students

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follow instructions and stay on task. Meanwhile, the mean is slightly lower (M = 4.58) for students demonstrating enthusiasm and focus during lessons, yet it still reflects strong behavioral commitment.

The learners' level of engagement in terms of behavioral aspects attained a weighted mean score of 4.64 and a standard deviation of 0.56 and was verbally interpreted as highly engaged.

In summary, students exhibit strong behavioral engagement by staying focused, following instructions, and demonstrating persistence in numeracy-literacy tasks.

A student's success in mathematics is not solely determined by their intellectual participation. In general, mathematical communication should not be overlooked as a key component of orchestrating the conversations and interactions between the various parties involved in the classroom, including the students, the instructor, and the students themselves. In an active learning context, one of the good practices in the mathematics classroom should also consider the social engagement of students, encouraging collaboration, either through small group activities or whole class discussions (NCTM, 2015).

Learners' Conceptual Understanding

The level of learners' conceptual understanding with respect to transfer of learning, logical reasoning, ability to take influence, and flexibility was treated statistically using mean and standard deviation.

TABLE 12. Level of Learners' Conceptual Understanding with Respect to Transfer of Learning

STATEMENT	**MEAN**	**SD**	**REMARKS**
I apply strategies to help students use mathematical concepts learned in class to solve real-world problems.	4.74	0.46	Strongly Agree
I create opportunities for students to apply literacy skills (e.g., reading comprehension, critical thinking) to mathematics tasks.	4.63	0.52	Strongly Agree
I integrate prior knowledge from other subjects (e.g., science, social studies) into my math lessons to apply cross-disciplinary learning.	4.68	0.49	Strongly Agree
I encourage students to apply their problem-solving processes through both written explanations and numerical reasoning.	4.66	0.51	Strongly Agree
I assess students' ability to apply mathematical concepts to different contexts or subjects.	4.64	0.52	Strongly Agree
Weighted Mean	*4.67*		
SD	*0.50*		
Verbal Interpretation	*Highly Proficient*		

Table 12 shows the level of learners' conceptual understanding with respect to transfer of learning. It also presents the statements, mean, standard deviation, and remarks.

Students demonstrate their ability to apply mathematical concepts in real-world situations and transfer literacy skills into numeracy-based tasks. The mean (M = 4.74) indicates a high level of transfer of learning when students apply mathematical concepts in real-world problems. Meanwhile, the mean is slightly lower (M = 4.63) for students transferring literacy skills to mathematics, yet it still indicates a strong ability to connect literacy and numeracy concepts.

The level of learners' conceptual understanding with respect to transfer of learning attained a weighted mean score of 4.67 and a standard deviation of 0.50 and was verbally interpreted as highly proficient.

In summary, students effectively transfer their learning by applying mathematical concepts to real-world scenarios, connecting prior literacy knowledge to numeracy tasks, and demonstrating adaptability in interdisciplinary learning.

Transfer of learning occurs, according to Perkins, D. & Salomon, G. (2017), when learning in one setting or with one set of resources affects performance in another setting or with other connected resources. Transfer is a key concept in education and learning theory because most formal education aspires to transfer. Usually the context of learning (classrooms, exercise books, tests, simple streamlined tasks) differs markedly from the ultimate contexts of application (in the home, on the job, within complex tasks). Consequently, the ends of education are not achieved unless transfer occurs. Transfer is even more important in that it cannot be taken for granted. There is ample proof that the desired transfer from learning experiences frequently fails to materialize. The possibilities and conditions of transfer are, therefore, important topics for instruction.

TABLE 13. Level of Learners' Conceptual Understanding with Respect to Logical Reasoning

STATEMENT	**MEAN**	**SD**	**REMARKS**
I analyze how students apply logical thinking to both numeracy and literacy-based tasks.	4.55	0.60	Strongly Agree
I recognize how students analyze and use logical thinking to tackle complex mathematical concepts.	4.58	0.50	Strongly Agree
I evaluate how students demonstrate a clear thought process when explaining their math solutions.	4.61	0.51	Strongly Agree
I assess how students apply logical reasoning in discussions of mathematical concepts.	4.54	0.59	Strongly Agree
I analyze how students transfer logical reasoning skills from reading comprehension to solving math problems.	4.55	0.50	Strongly Agree
Weighted Mean	*4.57*		
SD	*0.54*		
Verbal Interpretation	*Highly Proficient*		

Table 13 shows the level of learners' conceptual understanding with respect to logical reasoning. It also presents the statements, mean, standard deviation, and remarks.

Students showcase their ability to think logically when solving mathematical problems and explaining their reasoning. The mean (M = 4.61) indicates a high level of logical reasoning when students clearly articulate their thought processes in solving math problems. Meanwhile, the mean is slightly lower (M = 4.54) in terms of students engaging in discussions about mathematical concepts, though it still reflects a strong logical understanding.

Katherine V. Vicente, "Numeracy and Literacy Integration of Mathematics Teachers and the Learners' Motivation, Engagement and Conceptual Understanding of Elementary Learners," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 7, Issue 12, pp. 409-419, 2025.

The level of learners' conceptual understanding with respect to logical reasoning attained a weighted mean score of 4.57 and a standard deviation of 0.54 and was verbally interpreted as highly proficient.

In summary, students effectively apply logical reasoning by clearly explaining their solutions, justifying mathematical arguments, and engaging in discussions that enhance their comprehension of numeracy-literacy integration.

Reasoning skills are characterized as the inquiry processes of students to reexamine and reproduce their hypothesis about the world involved in experimentation, assessment, and induction, deriving logical understanding therefrom. It is the basis for students' procurement of logical information concurring with the strategies they utilize to find, survey, reexamine, and communicate that information (Andersen and Garcia-Mila, 2017).

TABLE 14. Level of Learners' Conceptual Understanding with Respect to Ability To Take Influence

STATEMENT	**MEAN**	**SD**	**REMARKS**
I apply strategies to help my students use concepts learned in literacy activities to solve mathematical problems.	4.70	0.50	Strongly Agree
I encourage students to apply their understanding of literacy skills (e.g., reading comprehension) to improve their mathematical performance.	4.62	0.54	Strongly Agree
I observe students applying knowledge from one subject area (literacy or numeracy) to enhance their learning in the other.	4.71	0.48	Strongly Agree
I recognize that my students apply vocabulary and language skills from literacy lessons to better articulate their mathematical reasoning.	4.65	0.50	Strongly Agree
I notice my students applying reading strategies (like summarizing or discussing) to help them tackle math problems.	4.61	0.58	Strongly Agree
Weighted Mean	*4.66*		
SD	*0.52*		
Verbal Interpretation	*Highly Proficient*		

Table 14 shows the level of learners' conceptual understanding with respect to the ability to take influence. It also presents the statements, mean, standard deviation, and remarks. Students demonstrate their ability to apply literacy concepts to mathematics and transfer knowledge from one subject to another. The mean (M = 4.71) indicates a high level of ability to take influence when students utilize prior knowledge from one subject area to enhance learning in another. Meanwhile, the mean is slightly lower (M = 4.61) in students using reading strategies to tackle math problems, yet it still signifies a strong ability to apply literacy skills in numeracy contexts.

The level of learners' conceptual understanding with respect to ability to take influence attained a weighted mean score of 4.66 and a standard deviation of 0.52 and was verbally interpreted as highly proficient.

In summary, students effectively integrate learning from different subjects, using reading comprehension strategies in mathematics and applying prior literacy experiences to improve mathematical reasoning.

Rosa, M., & Orey, D. C. (2015), state that learning to integrate numerical reasoning with literacy skills, students develop a better understanding of the context in which data is presented. For instance, reading statistical reports or interpreting data in various forms—such as charts and graphs—requires not only comprehension of the textual elements but also the ability to analyze and synthesize numerical information. This combined skill set enables students to draw informed conclusions, make sound arguments, and present ideas persuasively, thereby enhancing their ability to influence peers and participate in discussions meaningfully.

TABLE 15. Level of Learners' Conceptual Understanding with Respect to Flexibility

STATEMENT	**MEAN**	**SD**	**REMARKS**
I encourage my students to create and apply different strategies to solve mathematical problems involving reading and writing.	4.72	0.49	Strongly Agree
I recognize that my students can develop and adapt their approach when solving complex word problems.	4.57	0.52	Strongly Agree
I notice that my students demonstrate creativity and flexibility in switching between numeracy and literacy tasks during math lessons.	4.59	0.53	Strongly Agree
I recognize that my students feel confident experimenting with various methods to approach both literacy and numeracy challenges.	4.56	0.54	Strongly Agree
I observe students modifying and refining their problem-solving strategies based on the specific requirements of a task.	4.51	0.52	Strongly Agree
Weighted Mean	*4.59*		
SD	*0.52*		
Verbal Interpretation	*Highly Proficient*		

Table 15 shows the level of learners' conceptual understanding with respect to flexibility. It also presents the statements, mean, standard deviation, and remarks.

Students exhibit flexibility in solving numeracy-literacy tasks by using various strategies and adjusting their approach when necessary. The mean (M = 4.72) indicates a high level of flexibility when students apply different strategies to solve mathematical problems involving reading and writing. Meanwhile, the mean is slightly lower (M = 4.51) for students making adjustments to problem-solving strategies based on task requirements, though it still reflects strong adaptability.

The level of learners' conceptual understanding with respect to flexibility attained a weighted mean score of 4.59 and a standard deviation of 0.52 and was verbally interpreted as highly proficient.

In summary, students effectively demonstrate flexibility in numeracy-literacy tasks by exploring multiple problem-solving approaches, adjusting their strategies based on the complexity of tasks, and applying adaptive thinking to integrate literacy and numeracy concepts.

Flexibility is thus a crucial aspect of mathematical aptitude. This skill is employed to address issues involving several processes and to apply them flexibly to a variety of circumstances. As an illustration, when attempting to solve the same challenges, mathematicians employ a variety of methods

Katherine V. Vicente, "Numeracy and Literacy Integration of Mathematics Teachers and the Learners' Motivation, Engagement and Conceptual Understanding of Elementary Learners," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 7, Issue 12, pp. 409-419, 2025.

and select different methods to use, according to Rittle-Johnson, B. & Star, J. (2017).

Test of Significant Relationship between the Teachers' Integration of Numeracy and Literacy and the Learners' Motivation

To test the significant relationship between the teachers' integration of numeracy and literacy and the learners' motivation in terms of class participation, peer collaboration and task completion was treated statistically using Jamovi 2.3.28 using the Pearson correlation coefficient.

TABLE 16. Significant Relationship between Students' Learning Competencies and Work Behavior

Integration of Numeracy and Literacy (IV)	**Learner's Motivation (DV)**		
	Class Participation	Peer Collaboration	Task Completion
Teaching Strategy: Pearson Correlation Significance(2-Tailed) N	 0.62** <.001 107	 0.65** <.001 107	 0.58** <.001 107
Cross Subject Integration: Pearson Correlation Significance(2-Tailed) N	 0.60** <.001 107	 0.59** <.001 107	 0.54** <.001 107
Appropriate Activity: Pearson Correlation Significance(2-Tailed) N	 0.66** <.001 107	 0.62** <.001 107	 0.69** <.001 107
Complexity of Materials: Pearson Correlation Significance(2-Tailed) N	 0.60** <.001 107	 0.48** <.001 107	 0.55** <.001 107
Learning Pathways: Pearson Correlation Significance(2-Tailed) N	 0.68** <.001 107	 0.64** <.001 107	 0.61** <.001 107

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

The results of the Pearson correlation coefficients measure the strength and direction of the relationship between teachers' integration of numeracy and literacy and learners' motivation. A positive correlation indicates that as teachers integrate numeracy and literacy more effectively, learners' motivation also tends to increase. Correlations were computed among five integration aspects using data from 107 mathematics teachers. A correlation coefficient of 1 represents a complete positive correlation, whereas a coefficient of -1 represents a complete negative correlation.

The correlation coefficients range from 0.48 to 0.69, indicating a weak to moderate positive relationship between teachers' integration of numeracy and literacy and learners' motivation. Scale correlation analysis further supports these findings, showing that different aspects of integration exhibit varying levels of association with learner motivation. The overall scale correlation between numeracy and literacy integration and learner motivation is moderately strong, reinforcing the consistency of the relationship across different instructional strategies.

On the other hand, the lowest correlation (r = 0.48) was observed between complexity of materials and peer collaboration, indicating a weak positive relationship. This implies that while more complex materials can enhance student motivation, their impact on peer collaboration is less substantial.

Overall, these findings highlight the importance of well-structured activities and progressive learning pathways in fostering student motivation. Teachers who design engaging, interdisciplinary, and appropriately challenging tasks encourage higher levels of student participation, collaboration, and enthusiasm in learning.

Roache, J. & Lewis, R. (2016), reviews evidence-based practices in classroom management and their direct effects on student behavior. The authors discuss various strategies and their effectiveness in promoting positive behavior. The study concludes that implementing positive behavior support strategies, such as clear behavioral expectations and reinforcement, significantly reduces disruptive behaviors in the classroom. Teachers who utilize these strategies report improved student cooperation and a more positive learning environment.

Test of Significant Relationship between the Teachers' Integration of Numeracy Literacy and the Learners' Engagement

To test the significant relationship between the teachers' integration of numeracy literacy and the learners' engagement in terms of cognitive, physical and behavioral was treated statistically using Jamovi 2.3.28 using the Pearson correlation coefficient.

TABLE 17. Significant Relationship between the Teachers' Integration of Numeracy Literacy and the Learners' Engagement

Integration of Numeracy and Literacy (IV)	**Learners' Engagement (DV)**		
	Cognitive	Physical	Behavioural
Teaching Strategy: Pearson Correlation Significance(2-Tailed) N	 0.45** <.001 107	 0.50** <.001 107	 0.55** <.001 107
t Integration: Pearson Correlation Significance(2-Tailed) N	 0.55** <.001 107	 0.61** <.001 107	 0.59** <.001 107
Appropriate Activity: Pearson Correlation Significance(2-Tailed) N	 0.65** <.001 107	 0.67** <.001 107	 0.54* <.001 107
Complexity of Materials: Pearson Correlation Significance(2-Tailed) N	 0.56** <.001 107	 0.58** <.001 107	 0.64** <.001 107
Learning Pathways: Pearson Correlation Significance(2-Tailed) N	 0.56** <.001 107	 0.64** <.001 107	 0.61** <.001 107

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

The correlation coefficients measure the strength and direction of the relationship between teachers' integration of numeracy and literacy and learners' engagement. A positive correlation indicates that as teachers integrate numeracy and literacy more effectively, learners' engagement across cognitive, physical, and behavioral domains also tends to increase.

Correlations were computed among five integration aspects using data from 107 mathematics teachers. A correlation coefficient of 1 indicates a perfect positive

Katherine V. Vicente, "Numeracy and Literacy Integration of Mathematics Teachers and the Learners' Motivation, Engagement and Conceptual Understanding of Elementary Learners," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 7, Issue 12, pp. 409-419, 2025.

correlation, whereas a coefficient of -1 indicates a perfect negative correlation.

The correlation coefficients range from 0.45 to 0.67, indicating a weak to moderate positive relationship between teachers' integration of numeracy and literacy and learners' engagement. Scale correlation analysis confirms that the integration of numeracy and literacy consistently contributes to student engagement, with moderate associations across different aspects. The overall scale correlation suggests that structured learning pathways, interdisciplinary approaches, and interactive strategies have a cumulative effect on engagement.

On the other hand, the weakest correlation (r = 0.45) was found between teaching strategy and cognitive engagement, indicating a weak positive relationship. This implies that while teaching strategies contribute to student focus and mental engagement, other factors such as material complexity and real-world application may play a more significant role.

Overall, these results highlight the importance of interactive and structured learning experiences in fostering student engagement. Teachers who incorporate meaningful cross-subject connections, well-scaffolded tasks, and hands-on activities create a dynamic learning environment that enhances cognitive, physical, and behavioral involvement.

Furthermore, Lyon, Jafri, and St. Louis (2017) support the value of inquiry-based and active learning exercises in fostering students' capacity for critical thought and problem-solving. According to them, cross-subject exercises ought to motivate students to investigate intricate problems from several angles, for instance, by using role-playing situations that call for both reading and numeracy abilities. By fostering active engagement, these kinds of exercises not only inspire students but also advance a deeper conceptual grasp. Teachers can assist students relate their learning to the real world and improve their entire educational experience by including them in real-world applications.

Test of Significant Relationship between the Teachers' Integration of Numeracy and Literacy and the Learners' Conceptual Understanding

To test the significant relationship between the teachers' integration of numeracy and literacy and the learners' conceptual understanding in terms of transfer of learning, logical reasoning, ability to take influence and flexibility was treated statistically using Jamovi 2.3.28 using the Pearson correlation coefficient.

The correlation coefficients measure the strength and direction of the relationship between teachers' integration of numeracy and literacy and learners' conceptual understanding. A positive correlation indicates that as teachers integrate numeracy and literacy more effectively, learners' ability to transfer learning, reason logically, take influence, and demonstrate flexibility also tends to increase.

Correlations were computed among five integration aspects using data from 107 mathematics teachers. A correlation coefficient of 1 indicates a perfect positive correlation, while a coefficient of -1 indicates a perfect negative correlation.

TABLE 18. Significant Relationship between the Teachers' Integration of Numeracy and Literacy and the Learners' Conceptual Understanding

Integration of Numeracy and Literacy (IV)	**Learners' Conceptual Understanding (DV)**			
	Transfer of Learning	Logical Reasoning	Ability to Take Influence	Flexibility
Teaching Strategy: Pearson Correlation Significance(2-Tailed) N	0.62** <.001 107	0.55** <.001 107	0.52** <.001 107	0.52** <.001 107
ntegration: Pearson Correlation Significance(2-Tailed) N	0.67** <.001 107	0.60** <.001 107	0.61** <.001 107	0.75** <.001 107
Appropriate Activity: Pearson Correlation Significance(2-Tailed) N	0.64** <.001 107	0.66** <.001 107	0.56* <.001 107	0.62** <.001 107
Complexity of Materials: Pearson Correlation Significance(2-Tailed) N	0.58** <.001 107	0.53** <.001 107	0.44** <.001 107	0.57** <.001 107
Learning Pathways: Pearson Correlation Significance(2-Tailed) N	0.66** <.001 107	0.58** <.001 107	0.67** <.001 107	0.62** <.001 107

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

The correlation coefficients range from 0.44 to 0.75, indicating a weak to strong positive relationship between teachers' integration of numeracy and literacy and learners' conceptual understanding. Scale correlation analysis confirms that the integration of numeracy and literacy consistently enhances conceptual understanding, with moderate to strong associations across different aspects. The overall scale correlation suggests that cross-subject integration, structured learning pathways, and appropriate activities have a cumulative effect on learners' ability to apply and adapt knowledge. The strongest correlation (r = 0.75) was observed between cross-subject integration and flexibility, suggesting that interdisciplinary learning significantly enhances students' ability to adapt and apply different strategies in problem-solving. Similarly, learning pathways (r = 0.67) and appropriate activities (r = 0.66) showed moderate to strong correlations with logical reasoning and the ability to take influence, reinforcing the importance of structured and meaningful learning experiences.

On the other hand, the lowest correlation (r = 0.44) was found between complexity of materials and ability to take influence, indicating a weak positive relationship. This implies that while more complex materials can contribute to conceptual development, their role in helping students apply knowledge across different subjects may be limited.

Overall, these findings emphasize the crucial role of cross-subject integration, structured learning progressions, and interactive activities in enhancing students' conceptual understanding. Teachers who design interdisciplinary lessons,

Katherine V. Vicente, "Numeracy and Literacy Integration of Mathematics Teachers and the Learners' Motivation, Engagement and Conceptual Understanding of Elementary Learners," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 7, Issue 12, pp. 409-419, 2025.

encourage flexible thinking, and provide diverse problem-solving strategies help students develop a deeper and more transferable understanding of literacy and numeracy concepts.

Anney, V. (2016), investigated the literacy teaching practices in Tanzanian classrooms in the provision of primary education. It comprehensively assessed why primary school leavers do not have reading, writing and numeracy competencies. An objective that guided this study was to find out problems associated with the teaching and learning literacy skills in Tanzanian primary school classrooms. The study findings indicated that most of the teachers do not have adequate skills of teaching it. In addition, factors that contributed to illiteracy were pupils' late enrolment in standard one, shortages of teaching and learning resources, and parents' level of education, inadequate literacy teachers and teachers with poor literacy teaching skills.

IV. Conclusion and Recommendations

Integration of numeracy and literacy in teaching mathematics has a significant relationship on all indicators of learners' motivation resulting to the rejection of null hypothesis. This means that a well-structured integration of activities and learning pathways helped to foster student motivation.

All indicators of the integration of numeracy and literacy has a significant relationship on learners' engagement resulting to rejection of null hypothesis. This indicate that since teacher integrate numeracy and literacy in every lesson in teaching mathematics, learners' engagement tends to increase.

Integration of numeracy and literacy made by mathematics teachers has a significant relationship on learners' conceptual understanding resulting to rejection of null hypothesis. This means that cross subject integration, continued learning progression and interactive activities helped enhanced student conceptual understanding.

Based on the drawn conclusions resulted to the following recommendations:

Teachers may integrate numeracy and literacy in their instruction to support students' motivation. By connecting math and reading skills, they can make lessons more meaningful and engaging, encouraging active participation and task completion. Teachers may also use real-life contexts and collaborative tasks to strengthen students' interest, helping them see the importance of what they learn and stay committed to classroom activities.

Teachers may incorporate activities that combine numeracy and literacy to promote student engagement. By designing lessons that involve both mathematical and reading skills, students are more likely to stay actively involved and interested. Teachers may also include hands-on tasks and collaborative exercises to support cognitive, physical, and behavioral engagement throughout the learning process.

Teachers may incorporate both literacy and numeracy components into their math lessons to enhance students' conceptual understanding. By using reading tasks and written explanations alongside mathematical concepts, teachers can help students strengthen their ability to transfer knowledge across subjects. They may also encourage critical thinking and flexibility in problem-solving by fostering discussions and activities that require logical reasoning and adaptable strategies.

Future researchers may investigate the long-term effects of integrating numeracy and literacy on students' academic success. By examining how these integrated skills influence students' learning outcomes over extended periods, researchers could provide valuable insights into the sustained benefits of this approach. Additionally, they may consider factors such as varying educational contexts, teaching methods, and student backgrounds to better understand the broader inferences numeracy and literacy integration on academic achievement.

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