ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 6 (June 2026)

Enhancing Numeracy Retention Among Grade 10 Learners of Cawayan National High School: Key Factors and Effective Solutions

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Date Submitted:
June 12, 2026

Date Accepted:
June 12, 2026

Date Published:
June 16, 2026

DOI:
10.5281/zenodo.20717900

ABSTRACT

Mathematical competence is a key requirement for both academic achievement and real-life decision-making. Despite its importance, many junior high school learners encounter difficulty in retaining mathematical concepts over time. This study sought to examine the factors influencing numeracy retention among Grade 10 learners and assess the effectiveness of selected instructional strategies. A descriptive quantitative design was employed, involving forty-six (46) learners from Cawayan National High School through census sampling. Data were gathered using a structured questionnaire covering cognitive, instructional, psychological, and practical application factors, as well as selected teaching strategies. Statistical tools such as frequency, percentage, and weighted mean were used to analyze the data. Findings revealed that all four factors were perceived at a moderate level, with cognitive aspects registering the lowest mean and practical application the highest. Among the teaching approaches, differentiated instruction emerged as the most favorable, while reinforcement, flipped classroom, and cross-disciplinary integration showed moderate effectiveness. The results highlight the need for context-based, learner-centered strategies to improve retention and strengthen deeper understanding of mathematical concepts.

Keywords: *Numeracy retention, differentiated instruction, cognitive factors, Grade 10 mathematics, teaching strategies*

INTRODUCTION

Mathematical literacy plays a significant role in enabling learners to perform effectively in academic tasks and practical life situations. However, a considerable number of students face persistent challenges in retaining mathematical knowledge, particularly at the secondary level. This study aims to identify key factors that contribute to poor numeracy retention among Grade 10 learners of Cawayan National High School, Claveria North District, Province of Masbate, and propose effective solutions to address this issue.

Numeracy retention refers to the ability of learners to consistently recall, apply, and utilize previously learned mathematical concepts across different contexts over time.

Retention in numeracy means that learners not only acquire mathematical knowledge but are also able to retain and apply it over time. Research shows that strong numeracy skills impact students' long-term educational and socioeconomic outcomes (Ritchie & Bates, 2013). When students can effectively retain

ISSN: 3116-3475
International Journal
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Volume 2 Issue 6 (June 2026)

and utilize their numeracy skills, they are better prepared to solve real-world problems, engage in critical thinking, and make informed decisions.

One effective solution for enhancing numeracy retention is the use of real-world applications and hands-on learning experiences. According to Nunes and Bryant (1996), when students connect mathematical concepts to real-life situations, they are more likely to remember and understand those concepts. Additionally, repeated practice and spaced learning have been shown to reinforce numerical understanding and aid in long-term retention (Geary, 2013). Moreover, integrating technology, such as educational apps and interactive math games, provides personalized learning that adapts to students' individual pace and needs (Ginsburg & Gal, 1996).

The Department of Education (DepEd) adopts the National Learning Recovery Program (NLRP) through DepEd Order No. 013, s. 2023, which aims to strengthen learning recovery, improve literacy and numeracy, and accelerate the achievement of education targets. This program addresses learning gaps and challenges brought about by disruptions in education caused by the COVID-19 pandemic.

This study focuses on addressing this issue within the specific context of Cawayan National High School, aiming to identify and analyze the multifaceted factors contributing to poor numeracy retention among its Grade 10 learners. Specifically, this study sought to answer the following questions: (1) What factors do students face in understanding and retaining numeracy concepts as to cognitive factor, instructional factor, psychological factor, and practical application? (2) How effective are the existing teaching strategies in promoting numeracy retention in terms of differentiated instruction, reinforcement, flipped classroom, and cross-disciplinary integration? (3) What strategies are most effective in improving retention of numeracy skills?

METHODS

Research Design

This study utilized a descriptive quantitative research design to investigate the key factors influencing numeracy retention among Grade 10 learners at Cawayan National High School, Claveria North District. According to Best and Kahn (2007), descriptive research concerns itself with present phenomena in terms of conditions, practices, beliefs, processes, relationships, or trends. This approach enabled the researcher to establish a comprehensive understanding of the factors affecting numeracy retention and the effectiveness of teaching strategies.

A survey questionnaire was employed as the primary data collection tool. The questionnaire was divided into two main parts. Part I focused on four factors affecting numeracy retention: cognitive factors (5 items), instructional factors (5 items), psychological factors (5 items), and practical application (5 items). Part II examined four teaching strategies: differentiated instruction (5 items), reinforcement (5 items), flipped classroom (5 items), and cross-disciplinary integration (5 items). Students rated each statement using a five-point Likert scale ranging from 5 (Strongly Agree) to 1 (Strongly Disagree).

After securing approval from the research adviser, the Dean of the College of Graduate Studies, the school principal, and the Schools Division Superintendent, the researcher administered the questionnaire to 46 Grade 10 learners during regular class hours. Ethical considerations such as confidentiality, anonymity, and the right to withdraw were strictly observed. Data were analyzed using frequency count, percentage, and weighted mean.

Research Locale

The study was conducted at Cawayan National High School, located in the Municipality of Claveria, Province of Masbate, Philippines. Claveria is a 3rd class municipality situated in the southern portion of Burias Island. According to the 2020 census, Claveria has a population of 42,142 people. Cawayan National High School serves 22 barangays and provides secondary education to learners from

ISSN: 3116-3475
International Journal
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surrounding communities. The school site is situated in Barangay Cawayan, approximately 15 kilometers from the town proper.

Sampling Technique

The respondents of this study consisted of all 46 Grade 10 learners currently enrolled in mathematics classes at Cawayan National High School. A census sampling technique was utilized, which refers to a statistical method where data is collected from every single unit within a population, providing a complete picture of the population (also known as "complete enumeration" or "100% enumeration"). This sampling method was chosen to provide a comprehensive understanding of the factors that influence numeracy retention among Grade 10 learners at the school, as the population size was manageable for the researcher.

RESULTS AND DISCUSSION

Factors in Understanding and Retaining Numeracy Concepts

Cognitive Factor

Table 1.1. *Cognitive Factor*

Cognitive Factor Item	Mean	Interpretation
I easily connect new math lessons with what I have previously learned.	3.02	Neutral
I find it easy to understand mathematical concepts.	2.96	Neutral
I remember formulas and procedures in mathematics.	2.83	Neutral
I find solving math problems enjoyable and manageable.	2.72	Neutral
I quickly grasp and retain math concepts for easy recall.	2.65	Neutral
Weighted Score	2.84	Neutral

The weighted score of 2.84 indicates that students neither strongly agree nor strongly disagree with statements about their cognitive abilities related to math. The highest score (3.02) for connecting new lessons with prior knowledge suggests students have some success in building upon what they previously learned. The lowest score (2.65) for quickly grasping and retaining concepts points to potential weaknesses in processing speed and memory retention.

These findings align with Sweller's Cognitive Load Theory (1988), which suggests that reducing cognitive load during learning can improve retention. When students struggle to quickly grasp concepts, it may indicate that instructional materials are not optimally designed to minimize extraneous cognitive load. Furthermore, Desoete and Roeyers (2006) found that students who engaged in self-monitoring and reflection during problem-solving were more likely to retain numeracy skills. The neutral scores indicate that metacognitive strategies may not be explicitly taught or practiced in the classroom.

Instructional Factor

Table 1.2. *Instructional Factor*

Instructional Factor Item	Mean	Interpretation
My teacher provides clear and helpful feedback on my performance in math.	3.74	Positive
The teaching methods used are engaging and help me understand the lessons.	3.48	Neutral
Lessons are taught in a way that matches my learning style.	3.20	Neutral
I receive adequate opportunities to practice numeracy skills during class.	3.20	Neutral
The pace of lessons allows me enough time to fully understand the material.	2.91	Neutral
Weighted Score	3.31	Neutral

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International Journal
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Student feedback revealed a generally neutral perception of instructional factors. A clear strength emerged in teacher feedback (3.74, Positive), indicating students value and benefit from this aspect. This finding supports Black and Wiliam's (1998) research highlighting the importance of formative assessment in enhancing retention. Regular assessments that provide feedback help students identify areas of weakness and reinforce learning.

However, the neutral scores for other instructional factors reveal areas needing improvement. Lesson pacing received the lowest score (2.91), indicating that many students feel rushed and unable to fully understand material before moving on. This finding mirrors the challenges identified by Baesat (2019) at Tuy National High School, where students reported difficulties related to curriculum pacing and learning process. When lessons move too quickly, students experience increased cognitive load, leading to poorer retention (Paas & Sweller, 2014).

Psychological Factor

Table 1.3. *Psychological Factor*

Psychological Factor Item	Mean	Interpretation
I feel engaged in math lessons when the learning environment is supportive.	3.37	Neutral
I believe I have the ability to succeed in math tasks.	3.20	Neutral
Positive past experiences in math motivate me to learn new concepts.	3.17	Neutral
I feel confident when solving math problems.	3.00	Neutral
I feel comfortable participating even if I might make mistakes.	2.96	Neutral
Weighted Score	3.14	Neutral

The overall neutral score of 3.14 suggests students' psychological connection to math is neither a significant barrier nor a strong motivator. The finding that students feel less comfortable participating when mistakes are possible (2.96) reflects what Bandura (1997) described as self-efficacy beliefs influencing motivation and perseverance. Students who lack confidence are less likely to persist through challenging problems, leading to poorer retention.

The finding that students feel less comfortable participating when mistakes are possible reflects mathematical anxiety. Sarmiento (2023) found that fostering a growth mindset — believing abilities can improve with effort — resulted in higher retention of math concepts. Teachers at Cawayan National High School may benefit from explicitly teaching growth mindset principles. Interestingly, students rated engagement in supportive learning environments highest among psychological factors (3.37), indicating that when classrooms feel safe and encouraging, students are more engaged.

Practical Application

Table 1.4. *Practical Application*

Practical Application Item	Mean	Interpretation
I understand math concepts better when related to real-life situations.	3.98	Positive
Practicing math through real-world tasks improves my problem-solving skills.	3.33	Neutral
I find math more interesting when applied to daily activities.	3.30	Neutral
I enjoy math lessons involving practical applications like budgeting.	3.26	Neutral
Solving problems with real-world examples helps me retain numeracy concepts.	3.11	Neutral
Weighted Score	3.40	Neutral

The most striking finding is the strong positive response (3.98) for understanding math concepts better with real-life situations. This finding strongly supports Boaler's (2002) research, which found that students who learn math through practical, real-life problems demonstrate better understanding and retention. Students clearly recognize the value of connecting mathematics to their daily lives.

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International Journal
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However, a notable disconnects emerged: while students strongly agree that real-world connections improve *understanding*, they are neutral about whether these connections help them *retain* numeracy concepts (3.11). This suggests that while teachers may be using real-world examples, these applications may not be effectively designed to reinforce long-term memory. As Smith and Jones (2018) found, students exposed to real-world math problems were able to retain and apply numeracy skills more effectively compared to those who worked only on abstract problems — but this requires deliberate integration of real-world contexts into practice and assessment.

Summary of Factors

Table 1.5. *Summary of Factors Affecting Numeracy Retention*

Factor	Weighted Score	Interpretation	Rank
Practical Application	3.40	Neutral	1
Instructional Factor	3.31	Neutral	2
Psychological Factor	3.14	Neutral	3
Cognitive Factor	2.84	Neutral	4

All four factors fell within the neutral range. Cognitive factors ranked lowest, highlighting the need to address fundamental understanding, memory, and processing challenges. Psychological factors ranked second lowest, emphasizing the importance of building confidence and creating positive learning environments. The consistent neutrality across all factors underscores the need for a comprehensive approach to numeracy education, one that strengthens cognitive skills, addresses psychological needs, and enhances the effectiveness of instruction, including the integration of practical applications.

Teaching Strategies in Promoting Numeracy Retention

Differentiated Instruction

Table 2.1. *Differentiated Instruction*

Differentiated Instruction Item	Mean	Interpretation
My teacher provides additional support for students who need extra help.	3.72	Positive
Group activities and collaborative learning promote understanding.	3.57	Positive
My teacher adjusts task difficulty to match my learning ability.	3.52	Positive
Lessons are personalized to address student strengths and weaknesses.	3.50	Positive
Varied teaching methods help me retain numeracy concepts better.	3.24	Neutral
Weighted Mean	3.51	Positive

Students generally held a positive view of differentiated instruction. The highest rating (3.72) for additional support indicates a real strength in current practices. These findings are consistent with local research. Inandan (2019) found that students exposed to differentiated instruction at Lipa City National High School showed significant improvement in mathematics performance. Similarly, Domingo (2021) found that differentiated instruction significantly improves mathematics achievement.

However, the neutral score for varied teaching methods (3.24) suggests room for improvement. While teachers are differentiating by adjusting difficulty and providing support, they may not be using a wide enough range of teaching approaches. Incorporating more visual aids, manipulatives, hands-on activities, and technology-based tools could further enhance retention. As Smith and Jones (2015) found, students who used manipulatives scored significantly higher on numeracy tests than those who did not.

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International Journal
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Reinforcement

Table 2.2. *Reinforcement*

Reinforcement Item	Mean	Interpretation
My teacher provides positive feedback that boosts my confidence.	3.76	Positive
Verbal praises encourage me to participate in math activities.	3.48	Neutral
The use of incentives helps me stay focused during math lessons.	3.37	Neutral
I feel motivated when my efforts are acknowledged or rewarded.	3.28	Neutral
The reward system is fair and encourages healthy competition.	3.28	Neutral
Weighted Mean	3.43	Neutral

While positive feedback was highly rated (3.76), other reinforcement strategies received neutral scores. This finding supports Black and Wiliam's (1998) emphasis on formative assessment and timely feedback. Students clearly value and gain confidence from positive feedback on their performance.

However, while Kapp's (2012) work on gamification suggests that points, badges, and leaderboards can enhance engagement and retention, the neutral scores indicate these strategies may not be implemented consistently or effectively at Cawayan National High School. Students may perceive rewards as arbitrary or not meaningful, or the reward system may not be clearly linked to learning goals. The neutral score for motivation when efforts are acknowledged (3.28) suggests that while students appreciate positive feedback, they may not feel that their general efforts are sufficiently recognized.

Flipped Classroom

Table 2.3. *Flipped Classroom*

Flipped Classroom Item	Mean	Interpretation
Watching videos/reading materials before class helps me understand better.	3.28	Neutral
I feel more prepared for class when I review material beforehand.	3.24	Neutral
In-class problem-solving time helps me retain what I've learned.	3.13	Neutral
Online learning materials help me prepare for math lessons.	3.09	Neutral
I can learn math at my own pace with the flipped classroom approach.	3.02	Neutral
Weighted Mean	3.15	Neutral

All flipped classroom items received neutral scores, suggesting that students are not yet fully benefiting from this instructional model. This finding contrasts with Bergmann and Sams (2012), who introduced the flipped classroom as a method to improve engagement and retention. It also differs from Llona and Tonga (2020), who found that flipped classroom strategies enhanced conceptual understanding. Several factors may explain these neutral results. First, students may not have consistent access to technology or internet at home to watch instructional videos or access online materials. Second, the pre-class materials themselves may not be engaging or well-designed. Third, in-class activities may not effectively reinforce what students learned at home. The neutral score for learning at one's own pace (3.02) is particularly concerning, as this is one of the primary benefits of flipped learning.

Cross Disciplinary Integration

Table 2.4. *Cross Disciplinary Integration*

Cross Disciplinary Integration Item	Mean	Interpretation
Integration of math with other subjects makes concepts easier to remember.	3.28	Neutral
I am better able to retain math concepts when integrated with other subjects.	3.24	Neutral
Integration helps me see how math applies in real-world contexts.	3.09	Neutral
I find it easier to understand math when connected to other subjects.	3.02	Neutral
I can apply math skills in other subjects, helping me retain what I learn.	3.02	Neutral

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Weighted Mean	3.13	Neutral

All items received neutral scores, suggesting that while students may recognize the potential benefits of cross-disciplinary integration, the current implementation is not effectively enhancing their learning experience. Veishene and Dsouza (2022) defined cross-disciplinary integration as breaking down traditional subject boundaries to create richer learning experiences.

The lowest-rated items — applying math skills in other subjects (3.02) and understanding math better when connected to other subjects (3.02) — suggest that students do not see strong connections between math and their other classes. This may reflect a siloed curriculum where subjects are taught independently without deliberate coordination among teachers. Teachers should coordinate across departments to identify natural connections — for example, using math in science experiments, economics discussions, or technology projects.

Summary of Teaching Strategies

Table 2.5. *Summary of Teaching Strategies*

Teaching Strategy	Weighted Score	Interpretation	Rank
Differentiated Instruction	3.51	Positive	1
Reinforcement	3.43	Neutral	2
Flipped Classroom	3.15	Neutral	3
Cross Disciplinary Integration	3.13	Neutral	4

Differentiated instruction stood out as the only strategy with a positive rating. This finding suggests that learners retain math concepts more effectively when lessons are personalized to their individual needs. The neutral ratings for reinforcement, flipped classroom, and cross-disciplinary integration indicate these strategies may need better implementation or adjustment to support learner engagement and understanding.

Implications of the Findings

The findings of this study have several important implications for Cawayan National High School and similar educational contexts. First, the consistently neutral ratings across factors indicate that while no single area is failing, there is significant room for improvement across all aspects of numeracy instruction. A comprehensive approach addressing cognitive, instructional, psychological, and practical factors simultaneously is needed.

Second, the positive rating for differentiated instruction suggests that this approach should be expanded and strengthened. Teachers should receive professional development on varied teaching methods, including visual aids, manipulatives, hands-on activities, and technology integration. The success of differentiated instruction also supports the DepEd National Learning Recovery Program's emphasis on tailoring interventions to individual student needs.

Third, the disconnect between students' strong belief in real-world applications (3.98) and neutral retention outcomes (3.11) suggests that teachers need support in designing practical applications that explicitly reinforce retention, not just understanding. Contextualized learning materials grounded in local Claveria contexts — such as budgeting for fishing communities or measuring for local crafts — could bridge this gap.

Fourth, psychological factors, particularly confidence and comfort with mistakes, need targeted interventions. Growth mindset training, peer mentoring, math clubs, and low-stakes assessment environments could help address mathematical anxiety and build self-efficacy.

Limitations of the Study

Several limitations should be acknowledged. The study was conducted at a single school (Cawayan National High School) with a relatively small sample size (46 Grade 10 learners), which limits the generalizability of findings to other schools or grade levels. The use of self-reported survey data may introduce response bias, as students may have over-reported or under-reported their actual experiences. The cross-sectional design captures perceptions at a single point in time and does not measure actual numeracy retention through pre- and post-testing. Finally, the study did not examine external factors such as socio-economic status, parental involvement, or home learning environment that may influence numeracy retention.

CONCLUSION

This study examined the factors influencing numeracy retention among Grade 10 learners and identified instructional approaches that support improved learning outcomes. The findings indicate that while learners demonstrate moderate levels across cognitive, instructional, psychological, and practical dimensions, certain areas require focused intervention, particularly in strengthening conceptual understanding and learner confidence.

Among the teaching strategies, differentiated instruction proved to be the most effective, suggesting that tailoring instruction to learners' needs contributes to improved retention. Although students recognized the value of real-world applications, this did not consistently translate into long-term retention, indicating the need for more structured integration of contextual learning.

Overall, the study emphasizes the importance of adopting learner-centered and contextually relevant instructional practices to enhance numeracy retention and improve mathematics performance.

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