International Journal of Sustainability and Advanced Integrated Research
Volume 2, Issue 2 (April-June 2026) | ISSN: 3107-7854
DOI: https://doi.org/10.65339/ijsair.V2.I2.374

Level of Mastery in Fraction Computation Among Grade 10 Students at Dimasalang National High School: Basis for Intervention Program

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Publication history: Received: April 24, 2026; Revised: April 29, 2026; Accepted: May 06, 2026
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Abstract

This study assessed the mastery level of fraction computation among Grade 10 students at Dimasalang National High School as basis for a school intervention program. Anchored on Constructivist Learning Theory, Mastery Learning Theory, Cognitive Load Theory, and an Input-Process-Output framework, the study used a descriptive-quantitative research design. Data were gathered from 58 Grade 10 students through a structured questionnaire and diagnostic tool covering addition and subtraction, multiplication and division, mixed number and improper fraction conversion, application in word problems, fraction-solving strategies, common difficulties, and suggested improvement measures. The data were analyzed using frequency count, percentage, weighted mean, and Pearson correlation. Findings showed that students had satisfactory mastery in addition and subtraction and word problem application, moderate mastery in multiplication and division, and acceptable mastery in mixed number and improper fraction conversion. Students commonly used step-by-step procedures, while mental computation, visual representations, conversion strategies, and problem-solving methods were used only occasionally. The main difficulties involved lack of confidence in independent problem-solving, finding correct denominators, converting mixed numbers and improper fractions, and identifying operations in word problems. A strong and significant positive relationship was found between students' fraction-solving strategies and mastery level. The study concludes that while learners possess basic fraction computation skills, targeted interventions are needed to strengthen independence, conceptual understanding, and problem-solving confidence. The study aligns with SDG 4 – Quality Education and supports sustainable educational improvement by providing localized evidence for mathematics remediation, instructional planning, and learner-centered intervention.

Keywords: Cognitive Load Theory, Constructivist Learning Theory, Fraction Computation, Mathematics Education, Mastery Learning Theory, Problem-Solving Strategies, Quality Education, School Intervention, Sustainable Education

1. Introduction

Fraction computation is an essential foundation of mathematics learning because it supports arithmetic competence, algebra readiness, problem-solving ability, and higher-order mathematical reasoning. Although fractions are introduced early in the curriculum, many learners continue to experience difficulty because fractions require deeper conceptual understanding than whole numbers (Torbeyns et al., 2015). Students often depend on memorized procedures without fully understanding numerator-denominator relationships, equivalence, magnitude, and contextual application, which may lead to persistent errors in solving fraction-related problems (Singh et al., 2021). Since effective fraction learning requires the integration of conceptual understanding, procedural fluency, representational tools, and meaningful contexts, the present study assesses the mastery level of fraction computation among Grade 10 students at Dimasalang National High School as basis for a school intervention program (Wilkins & Norton, 2018).

Fractions are widely recognized as a critical mathematical concept because they serve as a bridge to algebraic thinking, proportional reasoning, and advanced mathematics. Tadeu (2024) emphasized the importance of continuous and systematic fraction instruction from early grades through K–10 because weak fraction knowledge may produce long-term learning gaps. Moeller and Spitzer (2022) found that early mastery of fractions significantly predicts later achievement in algebra, while Yuniara et al. (2020) reported that mastery of prerequisite skills such as whole numbers, division, and ratios contributes to fraction mastery. Similarly, Hibi (2024) found that numerical sense and written calculation ability are strongly associated with success in fraction and proportional reasoning. Despite the importance of fractions, students frequently encounter difficulties in computation and application. Rosli et al. (2024) found that many lower secondary students hold misconceptions about numerator-denominator relationships and fraction equivalence. Agustin et al. (2023) identified difficulties in adding fractions, especially in finding common denominators and understanding equivalent fractions, while Harun et al. (2023) reported that misconceptions in integer operations affect learners' ability to perform fraction operations. These findings indicate that fraction computation challenges are not only procedural but also conceptual, requiring targeted instructional support.

The reviewed literature shows that fraction mastery is influenced by foundational knowledge, conceptual understanding, instructional strategies, learning environment, assessment practices, and learner attitudes. Joutsenlahti and Perkkila (2024) emphasized the importance of flexible movement among symbolic, visual, and contextual representations, while Viernes and Seeping (2023) found that proficiency in fraction subconstructs predicts conceptual understanding in fraction arithmetic. These studies suggest that learners need more than rule-based procedures; they must understand how fractions represent quantities, relationships, and operations. Instructional innovation has also been shown to improve fraction learning. Ballenas (2023) found that technology-enhanced instruction improved computational skills in integers, fractions, and decimals, while Wardani et al. (2023) reported that the Ubiquitous Fraction App increased engagement and problem-solving performance. Satsangi et al. (2022) found that virtual manipulatives improved computational accuracy and conceptual understanding among learners with mathematics difficulties, and Satsangi et al. (2024) further showed that virtual number line intervention enhanced fraction comparison and computation skills. Odekeye and Jita (2024) also found that simulation-based instruction helped bridge learning gaps and improve fraction mastery. Game-based, visual, flipped, and model-based approaches have also been supported in the literature. Bhatia et al. (2022) found that game-based interventions improved students' conceptual and procedural understanding of fractions, while Ismaiel et al. (2024) reported higher mastery and motivation among students exposed to game-based learning. Mageed (2024) proposed a geometric approach using area models and visual partitions, Shalonda (2024) found that concrete and visual models improved Grade 7 learners' understanding of fractions, Cinense (2024) reported that a flipped classroom model increased mastery in addition and subtraction of fractions, and Nasayao et al. (2024) demonstrated that the Singaporean Mathematics approach improved conceptual understanding and procedural fluency. Mastery learning and diagnostic assessment also emerge as important themes. Zhang et al. (2024) found that higher mastery thresholds in earlier lessons positively influence later performance, while Marr (2024) reported that supportive learning environments and collaborative groupings enhance mathematical skill mastery. Noor (2024) developed a cognitive diagnostic assessment tool for measuring mastery in algebraic fractions, Domanais (2023) found that targeted remediation improved least mastered competencies, and Salim et al. (2024) found a positive relationship between students' attitudes toward mathematics and fraction sense proficiency. Related studies further confirm the need to balance conceptual and procedural learning. Nqabeni (2023) found that learners often demonstrate surface-level procedural knowledge without deep conceptual grasp, while Li (2024) showed that students may perform procedures accurately but differ in their conceptual explanations. Siregar et al. (2023) found that structured instructional media enhanced procedural fluency, while Schulz (2023) identified gaps in procedural fluency and strategic competence among student teachers. Pedersen et al. (2023) found that high-performing students showed stronger conceptual connections and flexible strategy use. Dube and Maseko (2024) and Doni and Probawanto (2024) found that many student errors arise from relational misunderstanding, comprehension errors, and transformation errors rather than simple arithmetic mistakes. Several studies also point to the importance of learner characteristics, metacognition, and differentiated support. Pradinar et al. (2023) found that numeracy ability and self-efficacy affect students' performance in fraction-related materials, while Hafiz et al. (2022) reported that mastery of basic mathematics affects learners' ability to solve complex problems. Wolff et al. (2024) found that many students overestimate their mastery of fractions, suggesting the importance of self-assessment accuracy. Powell et al. (2026), Loriente et al. (2025), Lucy et al. (2024), Asril and Purwanta (2024), Winanda et al. (2024), and Latif and Sharill (2024) collectively support the effectiveness of explicit instruction, personalized learning, higher-order thinking activities, context-based concrete media, project-based learning, mastery learning, and blended station rotation models in improving fraction and numeracy performance.

Globally, studies show that fraction computation remains a persistent learning concern across grade levels and learner groups. International studies emphasize the role of conceptual understanding, visual representation, personalized instruction, and digital learning tools in improving mastery. Palculict (2022) found that computer-assisted instruction improved fraction achievement, Jarrah et al. (2022) reported that digital games-based learning improved performance in learning fractions, Prihandini et al. (2023) developed Smart Fractions using iSpring Suite 9 and GeoGebra to enhance computational thinking, Han and Lin (2024) found that structured mathematics writing improved reasoning and conceptual articulation, and Abdulaziz (2024) found that video-based instruction improved fraction computation among students with autism spectrum disorder. Studies on mathematical modelling and word problems also highlight the need to strengthen learners' application skills. Govender and Machingura (2023) found that Grade 10 learners struggled to translate word problems into mathematical representations, while Sibiya and Essien (2024) emphasized that textbook design influences the development of proficiency in fraction word problems. Tian et al. (2024) used the SOLO taxonomy to evaluate computation skills and found varying levels of structural understanding. Millamena (n.d.) also emphasized the value of instructional materials in improving engagement and comprehension in fractions. In the Philippine context, local studies affirm the importance of contextualized, learner-centered, technology-supported, and assessment-driven mathematics instruction. Sanchez and Pasia (2023) found that reality pedagogy improved Grade 10 students' numeracy skills, while Apelo and Arcenas (2023) emphasized that connecting mathematics to authentic situations improves problem-solving and comprehension. Camarines (2024) similarly reported that experiential and contextual learning strategies enhance numeracy outcomes. Legal (2024) found that a Strategic Intervention Material improved Grade 4 students' mastery of fractions, Rosales et al. (2024) reported gains from a Summer Arithmetic Enhancement Initiative for Grade 7–10 students, and Espiritu and Vendicacion (2024) found that Sequential Learning Activities improved performance in dividing fractions.

Other local studies reinforce the need to address prerequisite skills, numeracy, misconceptions, and learning gaps. Ching and De Guzman (2024) found that simulation tools enhanced mastery of essential learning competencies in Mathematics 8, while Llona and Tonga (2020) showed that flipped classroom lessons improved Grade 10 mathematics performance and engagement. Deri and Ebio (n.d.) found that formative assessment improved understanding and performance in Grade 10 Mathematics, and Batucan et al. (n.d.) emphasized the importance of diagnostic assessment in tailoring instruction to student needs. Morata (2024), Catacutan and Cajandig (2024), and Raza (n.d.) highlighted the role of prerequisite skills and arithmetic foundations in mathematics readiness. Silva and Aldover (2024) found a significant relationship between numeracy proficiency and mathematics achievement, while Dictado and Dagdag (2025) identified weak foundational knowledge, limited conceptual understanding, insufficient practice, and negative attitudes as barriers to mathematics proficiency. At the local school level, the present study is situated at Dimasalang National High School in Dimasalang, Masbate, focusing on Grade 10 students during school year 2023–2024. It examines mastery in addition and subtraction, multiplication and division, mixed number and improper fraction conversion, and application in word problems. It also considers students' strategies, including mental computation, step-by-step procedures, visual representations, conversion techniques, and problem-solving methods.

The study is anchored on Constructivist Learning Theory (Piaget, 1952; Vygotsky, 1978), Mastery Learning Theory (Bloom, 1968), and Cognitive Load Theory (Sweller, 1988). Constructivist Learning Theory (Piaget, 1952; Vygotsky, 1978) explains that learners actively construct knowledge from prior experiences and social interaction. In the context of fraction computation, this means that students must build meaningful understanding of numerators, denominators, equivalence, operations, and real-life applications rather than merely memorizing procedures. Mastery Learning Theory (Bloom, 1968) supports the study by emphasizing that students can achieve higher levels of understanding when they are provided with sufficient time, instructional support, feedback, and remediation. Since fraction computation requires progressive mastery from basic operations to word problem application, identifying students' least mastered skills can guide differentiated instruction and intervention planning. Cognitive Load Theory (Sweller, 1988) explains that learning is affected by the mental effort required to process information. Fraction computation involves several cognitive processes, including identifying relationships between numbers, selecting appropriate operations, converting forms, and solving multi-step problems. When these tasks overload students' working memory, errors and incomplete understanding may occur. These theories collectively justify the assessment of students' mastery level, strategies, and difficulties as bases for targeted instructional intervention. The study also follows an Input-Process-Output framework. The input includes students' mastery level, fraction-solving strategies, common difficulties, and suggested measures. The process includes survey questionnaires, data gathering, presentation, analysis, and interpretation of data. The output is the identified mastery level of fraction computation among Grade 10 students at Dimasalang National High School, which may serve as basis for intervention.

The literature provides extensive evidence on the importance of fraction mastery and the effectiveness of interventions such as technology-enhanced instruction, game-based learning, visual models, formative assessment, mastery learning, and strategic intervention materials. However, studies remain limited in examining the actual mastery level of fraction computation among Grade 10 students in a specific local school context. While existing studies show that students commonly struggle with conceptual understanding, procedural fluency, and application of fraction operations, there is still a need for localized empirical data that identifies the specific mastery level, strategies, and difficulties of learners at Dimasalang National High School. This study addresses that gap by assessing students' mastery in key areas of fraction computation and determining whether their fraction-solving strategies are significantly correlated with their mastery level. It also identifies common difficulties and recommended measures to improve students' performance. The findings are expected to provide evidence for a school-based intervention program that responds to the actual learning needs of Grade 10 students, particularly in strengthening conceptual understanding, procedural accuracy, and problem-solving skills.

The study is primarily aligned with SDG 4 – Quality Education because it focuses on improving mathematics learning, identifying learning gaps, and supporting instructional interventions that may enhance students' mastery of fraction computation. By assessing learners' strengths and weaknesses, the study contributes to evidence-based teaching practices, remedial instruction, and improved mathematics competence. The study may also support SDG 9 – Industry, Innovation and Infrastructure in relation to the literature emphasizing technology-enhanced instruction, digital applications, simulation tools, virtual manipulatives, computer-assisted instruction, and flipped classroom models as possible approaches to strengthen mathematics learning. Ballenas (2023), Wardani et al. (2023), Satsangi et al. (2022), Satsangi et al. (2024), Odekeye and Jita (2024), Ching and De Guzman (2024), Llona and Tonga (2020), Palculict (2022), Jarrah et al. (2022), and Prihandini et al. (2023) support the role of technology and innovation in improving fraction mastery. The study also has an indirect connection to SDG 10 – Reduced Inequalities because identifying students' learning difficulties can guide differentiated support for learners who struggle with mathematics. Studies involving learners with mathematics difficulties, slow learners, and students with autism spectrum disorder, such as Satsangi et al. (2022), Satsangi et al. (2024), Abdulaziz (2024), Powell et al. (2026), and Asril and Purwanta (2024), show the importance of inclusive and responsive mathematics instruction.

The study contributes to educational sustainability by generating localized evidence that may help improve mathematics instruction, remediation, and intervention planning. Since mathematical competence supports academic progression, logical reasoning, and problem-solving, strengthening fraction computation can contribute to students' long-term readiness for higher-level mathematics and future learning opportunities. The study also contributes to technological and innovation sustainability by recognizing the value of digital tools, simulations, virtual manipulatives, and blended learning strategies in addressing persistent mathematics difficulties. It supports institutional sustainability by providing school administrators and mathematics teachers with data that can guide curriculum enhancement, instructional planning, teacher support, and resource allocation. It further contributes to socio-economic sustainability because stronger mathematical skills may help learners become better prepared for academic, personal, and future professional tasks that require numeracy, decision-making, and problem-solving. Overall, the study is significant because it links mathematics mastery, evidence-based intervention, learner support, and sustainable educational improvement within the local context of Dimasalang National High School.

2. Material and methods

2.1 Research Design

The study employed a descriptive-quantitative research design. This design was used to systematically measure and analyze the mastery level of Grade 10 students in fraction computation through structured questionnaires and diagnostic tools. The quantitative data were statistically analyzed to determine students' mastery level, identify suggested measures for improvement, and examine the significant correlation between students' fraction-solving strategies and their mastery level.

2.2 Locale of the Study

The study was conducted at Dimasalang National High School in the municipality of Dimasalang, Masbate. The school served as the research site because the study focused on assessing the mastery level of fraction computation among its Grade 10 students. The locale provided the classroom-based setting needed to gather data on students' fraction computation performance, strategies, and difficulties.

2.3 Respondents of the Study

The respondents of the study were Grade 10 students of Dimasalang National High School. The study specifically focused on learners whose fraction computation mastery could be assessed in terms of addition and subtraction, multiplication and division, mixed number and improper fraction conversion, and application in word problems. The respondents also provided information on the strategies they used in solving fractions and the difficulties they encountered in performing fraction computations.

2.4 Sample and Sampling Procedure

Convenience sampling was used in selecting the respondents. This non-probability sampling method was employed because the participants were chosen based on their availability, accessibility, and willingness to participate in the study. Although this method did not give all members of the population an equal chance of selection, it was considered appropriate due to time, access, and administrative considerations. A total of 58 copies of the survey instrument were reproduced and distributed to the respondents.

2.5 Research Instrument

The main instrument used in the study was a questionnaire designed to gather data on the mastery level of fraction computation among Grade 10 students. The instrument covered mastery in addition and subtraction, multiplication and division, mixed number and improper fraction conversion, and application in word problems. It also gathered data on students' fraction-solving strategies, including mental computation, step-by-step procedures, visual representations, conversions, and problem-solving methods, as well as suggested measures for improving fraction mastery. The questionnaire used Likert-scale items to quantify respondents' perceptions and experiences. It was reviewed by experts in educational research for validity, pilot-tested among a small group of comparable respondents, and tested for reliability using Cronbach's alpha.

2.6 Data Gathering Procedure

After the thesis proposal was approved by the school thesis committee, the researcher secured permission to conduct the study. The permit was noted by the researcher's adviser and submitted to the Schools Division Superintendent for approval before the questionnaires were released to the Grade 10 students. The survey instrument was first prepared, approved by the thesis adviser, validated by teachers and other education-related individuals, revised, finalized, reproduced, and distributed to the respondents with their approval. The accomplished questionnaires were retrieved beyond the expected one-month timeframe, which delayed the processing of the data. The respondents voluntarily participated and were assured that their responses would be kept confidential and used only for academic purposes.

2.7 Data Analysis Techniques

The collected responses were tallied in frequency tables and subjected to statistical treatment with the assistance of an expert statistician. Frequency count and percentage were used to describe the respondents' profile and responses. Weighted mean was used to determine the numerical representation of students' mastery level in solving fractions. Pearson correlation was used to determine whether there was a significant relationship between the fraction-solving strategies of Grade 10 students and their mastery level. The findings were then described, analyzed, interpreted, and used as basis for drawing implications and preparing the succeeding chapters of the manuscript.

3. Results and Discussion

3.1 Mastery Level of Grade 10 Students in Fraction Computation

3.1.1 Addition and Subtraction of Fractions

The results showed that Grade 10 students had a satisfactory level of mastery in addition and subtraction of fractions, with an overall weighted mean of 2.79, interpreted as Agree. The highest-rated skill was correctly adding and subtracting fractions with the same denominator, with a weighted mean of 3.22. This was followed by adding and subtracting fractions with different denominators at 2.81, teaching classmates how to solve addition and subtraction of fractions at 2.79, and solving word problems involving these operations at 2.69. However, students disagreed that they could solve addition and subtraction of fractions independently without guidance, which obtained the lowest weighted mean of 2.45. These findings indicate that students were more confident in performing basic fraction operations, especially when denominators were the same, but their confidence decreased when independent problem-solving was required. The result suggests the need to strengthen learner autonomy and conceptual understanding, especially because fraction errors may arise from relational misunderstandings rather than simple arithmetic mistakes. Shalonda (2024) revealed that concrete and visual models improved Grade 7 learners' understanding of fractions and reduced computational errors, while Cinense (2024) found that the flipped classroom model improved engagement and mastery in addition and subtraction of fractions. Nqabeni (2023) also emphasized the need to strengthen conceptual instruction, and Dube and Maseko (2024) found that many fraction errors stem from relational misunderstandings.

3.1.2 Multiplication and Division of Fractions

The results showed that Grade 10 students demonstrated a moderate level of mastery in multiplication and division of fractions, with an overall weighted mean of 2.62, interpreted as Agree. The highest-rated indicator was correctly multiplying and dividing fractions with the same denominator, with a weighted mean of 2.97. This was followed by solving word problems involving multiplication and division at 2.71, teaching classmates how to solve multiplication and division of fractions at 2.64, and multiplying and dividing fractions with different denominators at 2.55. The lowest-rated indicator was solving multiplication and division of fractions independently without guidance, with a weighted mean of 2.26, interpreted as Disagree. These findings suggest that students could perform multiplication and division of fractions when the task was familiar or guided, but they still relied on assistance when solving independently. The result implies that students need more practice opportunities, guided remediation, and confidence-building activities to strengthen independent computation. Since multiplication and division of fractions require procedural accuracy and conceptual understanding, the low rating in independent work indicates the need for instructional support that gradually moves learners from guided practice to autonomous problem-solving.

3.1.3 Conversion Between Mixed Numbers and Improper Fractions

The results showed that students had an acceptable level of mastery in converting mixed numbers and improper fractions, with an overall weighted mean of 2.51, interpreted as Agree. Students rated themselves highest in simplifying fractions after conversion, with a weighted mean of 2.64. This was followed by converting improper fractions to mixed numbers at 2.59 and converting mixed numbers to improper fractions at 2.55. However, students disagreed that they could use conversions to solve fraction problems, which obtained a weighted mean of 2.41, and solve word problems involving conversions, which obtained the lowest weighted mean of 2.38. These results indicate that students could perform the mechanical steps of conversion but had difficulty applying conversion skills in problem-solving and real-life contexts. This suggests a gap between procedural knowledge and contextual application. Although learners may know how to change one form of fraction into another, they still need more meaningful exercises that require them to decide when and how conversion should be used in solving mathematical problems.

3.1.4 Application in Word Problems

The results showed that students demonstrated a satisfactory level of mastery in applying fraction skills to word problems, with an overall weighted mean of 2.80, interpreted as Agree. The highest-rated indicator was solving word problems involving addition and subtraction of fractions, with a weighted mean of 2.98. This was followed by identifying the correct operation needed in fraction word problems at 2.90, solving word problems involving multiplication and division at 2.78, checking answers for accuracy at 2.76, and explaining the solution process clearly at 2.57. These findings show that students were generally capable of solving contextualized fraction problems, especially those involving basic operations, but were less confident in explaining their reasoning. This implies that students may know how to compute but may still need support in mathematical communication and reasoning. Govender and Machingura (2023) found that Grade 10 learners struggled to translate word problems into mathematical representations, while Sibiya and Essien (2024) emphasized that textbook design affects learners' problem-solving development. Tian et al. (2024) also found varied levels of structural understanding in computation skills, ranging from surface to relational learning.

3.2 Fraction-Solving Strategies Employed by Grade 10 Students

3.2.1 Mental Computation

The results showed that mental computation was moderately used by students, with an overall weighted mean of 2.67, interpreted as Sometimes. The highest-rated indicator was solving simple fraction operations mentally, with a weighted mean of 2.93. This was followed by estimating answers mentally before solving problems at 2.71, using mental calculation to check answers at 2.64, and using mental shortcuts for addition or subtraction at 2.59. The lowest-rated indicator was mentally multiplying or dividing fractions when possible, with a weighted mean of 2.48, interpreted as Rarely. These findings indicate that students used mental computation mainly for simple fraction tasks but avoided it for more complex operations such as multiplication and division. This suggests that mental strategies were present but not consistently developed across all fraction skills. Ballenas (2023) found that technology-enhanced instruction improved computational skills in integers, fractions, and decimals, while Satsangi et al. (2024) demonstrated that virtual number line intervention enhanced fraction comparison and computation skills while reducing misconceptions.

3.2.2 Step-by-Step Procedures

The results showed that students commonly employed step-by-step procedures, with an overall weighted mean of 3.11, interpreted as Sometimes. The highest-rated indicator was following a step-by-step method when solving fraction problems, with a weighted mean of 3.29, interpreted as Always. Students also wrote intermediate steps when multiplying or dividing fractions, with a weighted mean of 3.22, wrote intermediate steps when adding or subtracting fractions at 3.14, applied step-by-step procedures in word problems at 3.00, and followed standard procedures for converting fractions at 2.91. These findings suggest that students relied on organized and sequential procedures to guide their thinking and improve accuracy. However, the lower rating for conversion procedures indicates that this area still needs reinforcement. Raza (n.d.) emphasized the role of arithmetic principles and operations in shaping students' mathematics performance, noting that weak arithmetic foundations affect learners' ability to understand complex procedures and perform higher-level problem-solving tasks.

3.2.3 Visual Representations

The results showed that visual representations were moderately used by students, with an overall weighted mean of 2.53, interpreted as Sometimes. The highest-rated indicators were using diagrams or fraction bars to understand fraction problems and checking solutions using visual aids, both with weighted means of 2.59. Drawing pie charts to represent fractions obtained 2.57, using visual representations to solve word problems obtained 2.53, and using visual models to compare fractions obtained the lowest weighted mean of 2.38, interpreted as Rarely. These findings indicate that students recognized the usefulness of visual aids but did not consistently apply them, especially in comparing fractions. This suggests the need to strengthen the use of diagrams, fraction bars, pie charts, and other visual models as regular problem-solving supports. Fabros and Ibañez (2023) found that graphic organizers improved conceptual understanding of fraction operations and significantly enhanced clarity and comprehension.

3.2.4 Conversion Strategies

The results showed that conversion-related strategies supported by visual representations were moderately employed, with an overall weighted mean of 2.59, interpreted as Sometimes. Students rated the use of diagrams or fraction bars to understand fraction problems highest, with a weighted mean of 2.76. This was followed by checking solutions using visual aids at 2.66, drawing pie charts to represent fractions at 2.62, and using visual models to compare fractions at 2.53. The lowest-rated indicator was using visual representations to solve word problems, with a weighted mean of 2.36, interpreted as Rarely. These results suggest that students occasionally used visual and representational tools to support conversion tasks, but these strategies were not consistently applied in contextual problem-solving. The result highlights the need for more practice in connecting conversion skills with visual reasoning and real-world applications. Powell et al. (2026) found that explicit instruction, visual representations, and systematic practice were consistently effective, while Apelo and Arcenas (2023) emphasized that connecting mathematical concepts to authentic situations improves problem-solving ability and comprehension.

3.2.5 Problem-Solving Methods

The results showed that problem-solving methods involving visual and representational strategies were moderately used, with an overall weighted mean of 2.55, interpreted as Sometimes. Students rated the use of diagrams or fraction bars to understand fraction problems highest, with a weighted mean of 2.60. This was followed by drawing pie charts to represent fractions at 2.59, using visual models to compare fractions at 2.55, checking solutions using visual aids at 2.52, and using visual representations to solve word problems at 2.50, interpreted as Rarely. These findings show that students sometimes used visual and structured methods, but their use was inconsistent, especially in word problems. This implies that learners need more guided exposure to problem-solving strategies that combine computation, representation, and reasoning. Strengthening these strategies may help students become more confident in selecting appropriate approaches and explaining their solutions.

3.3 Common Difficulties Encountered in Fraction Computation

The results showed that students encountered difficulties in fraction computation infrequently, with an overall weighted mean of 2.49, interpreted as Rarely. The highest-rated difficulty was lack of confidence when solving fraction problems independently, with a weighted mean of 2.57. This was followed by difficulty in finding the correct denominator when adding or subtracting fractions and struggling to convert mixed numbers and improper fractions, both with weighted means of 2.52. Confusion in identifying the correct operation in word problems obtained 2.45, while making errors in multiplying or dividing fractions obtained the lowest weighted mean of 2.38. These findings indicate that the students' main difficulty was not only computational but also affective, particularly their lack of confidence in independent problem-solving. Procedural concerns were also present, especially in denominators and conversion. Magbag and Tayag (n.d.) found that common errors in fractions involve numerator-denominator relationships, incorrect application of operations, and misunderstanding of equivalent fractions. Agustin et al. (2023) identified difficulties in finding common denominators and understanding equivalent fractions, while Rosli et al. (2024) found that misconceptions about numerator-denominator relationships and fraction equivalence hinder procedural fluency and conceptual clarity.

3.4 Relationship Between Fraction-Solving Strategies and Mastery Level

The results showed a strong and significant positive relationship between students' fraction-solving strategies and their mastery level. The computed r-value was 0.73, interpreted as a strong positive linear relationship. With 56 degrees of freedom, a 0.05 level of significance, and a two-tailed critical r-value of ±0.2586, the computed r-value was greater than the critical value; therefore, the null hypothesis was rejected. This result means that students who consistently used effective fraction-solving strategies tended to demonstrate higher mastery in fraction computation. In practical terms, mental computation, step-by-step procedures, visual representations, conversion strategies, and structured problem-solving methods were associated with better proficiency and confidence. This supports the importance of teaching and reinforcing effective strategies because these approaches can improve students' accuracy, independence, and understanding in solving fraction problems.

3.5 Suggested Measures to Improve Students' Mastery of Fraction Computation

The results showed that students agreed with the suggested measures to improve fraction mastery, with an overall weighted mean of 3.09. The highest-rated measure was providing regular practice activities, with a weighted mean of 3.22. This was followed by peer or group activities at 3.16, step-by-step teaching at 3.10, activities aligned with learning needs at 3.00, and the use of visual aids at 2.95. These findings suggest that students viewed consistent practice and collaborative learning as the most helpful ways to improve their fraction computation skills. Structured lessons, individualized activities, and visual aids were also considered useful for strengthening mastery. Salim et al. (2024) found a significant positive relationship between students' attitudes toward mathematics and fraction sense proficiency, suggesting that affective factors influence mastery. Legal (2024) also evaluated the Mathematics Enhancement Tool as a Strategic Intervention Material in teaching fractions and found improvements in students' fraction mastery after exposure to the intervention material.

4. Conclusion & Recommendations

Grade 10 students at Dimasalang National High School demonstrated general mastery of basic fraction computation, particularly in addition, subtraction, multiplication, division, conversion of mixed numbers and improper fractions, and solving word problems using basic operations. However, their performance showed dependence on guidance, especially in solving fractions independently, applying conversions in problem situations, using visual models, and solving multiplication and division tasks mentally. The students commonly used mental computation for simpler tasks and step-by-step procedures, but visual representations, conversion strategies, and problem-solving methods were used only occasionally. Their main difficulties included lack of confidence, errors in multiplication and division, difficulty finding correct denominators, and confusion in identifying operations for word problems. The study also concluded that there was a strong and significant positive relationship between students' fraction-solving strategies and their mastery level, and that regular practice and peer or group activities were viewed as helpful in improving mastery.

Based on the findings, teachers should design activities and interventions that strengthen students' ability to solve fractions independently. They should regularly use visual tools such as diagrams, fraction bars, and other representations to help learners conceptualize and compare fractions, particularly in basic operations. Targeted support and practice should be provided for multiplication and division of fractions, including strategies for identifying the correct operations in fraction word problems. Teachers should also adopt varied teaching strategies and implement regular practice sessions involving paired or group activities so students can learn collaboratively and build confidence. Further studies may be conducted in other areas within the same province using a larger sample.

The study was limited to the mastery of fraction computation among Grade 10 students of Dimasalang National High School during school year 2023–2024. It focused only on addition and subtraction, multiplication and division, conversion between mixed numbers and improper fractions, application in word problems, fraction-solving strategies, common difficulties, and suggested measures for improvement. It did not cover other mathematics topics, long-term retention of fraction skills, or external factors such as parental support, socioeconomic status, and teacher effectiveness, although these factors may influence mathematics performance.

Compliance with ethical standards

The study adhered to institutional ethical standards in the conduct of research. Participation was voluntary, and informed consent was obtained from the respondents before data collection. The confidentiality and privacy of all responses were observed, and the gathered data were used solely for academic purposes. Ethical approval or permission was secured from the concerned authorities, and no conflict of interest was declared by the researcher. All contributions were properly acknowledged, and the authors accepted full responsibility for the integrity, originality, and copyright ownership of the study.

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