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Mathematical Error Patterns Among Junior High Students with Mathematical Learning Difficulties in Palawan

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Abstract

Numerous curricular and policy changes aim to enhance mathematics educa-tion in the Philippines; however, the country continues to perform poorly in international assessments like PISA and TIMSS. This study investigates the mathematical error patterns and problem-solving strategies among junior high students with mathematical learning difficulties (MLD) in Palawan, using an explanatory sequential mixed-methods approach. Quantitative analysis identified common errors, including comprehension (75.32%), transformation (81.23%), and presentation (94.03%), with rural students showing significantly higher trans-formation errors (= 9.48, SD = 1.377) than urban students (= 8.35, SD = 2.418), $\mathbf{t_{75}}$=−2.479, p = 0.016, Cohen's d=−0.577. Qualitative focus group discussions revealed challenges in understanding basic math concepts and word problems, often exacerbated by limited instructional support. The findings underscore the need for targeted interventions, such as professional development for teachers, equitable resource distribution, and enhanced instructional strategies to improve foundational math skills and problem-solving abilities among students with MLD in Palawan.

1 Introduction

Over the years, the Philippine education system has continuously reformed its mathe-matics curriculum, prioritizing critical thinking, problem-solving, and the integration of technology. These initiatives aim to modernize instruction and equip students with the skills needed to excel in complex mathematical concepts. Despite dedicated efforts to strengthen the country's mathematics education, recent assessments from both PISA in 2018 and 2022 have consistently revealed below-par performance levels. Scor-ing 353 points in 2018 and experiencing only a marginal increase to 355 points in 2022, the country continues to significantly lag behind the global average of 472 points. Filipinos rank among the lowest-performing nations in terms of mathematics profi-ciency, with only a limited number of students achieving top-level scores (Level 5 or 6) in either assessment. Moreover, 71.8% of Filipino students who participated in PISA 2022 failed to reach the minimum proficiency level in mathematics [1, 2]. Despite the slight increase in average scores between the two assessments, the OECD considered the improvement statistically insignificant, emphasizing the persistent challenges in improving mathematics education outcomes nationwide.

The Second Congressional Commission on Education in the Philippines recognized

this concern and described the country's educational situation as a crisis of "misedu-cation" [3]. This condition is reflected in the country's performance in internationally recognized assessments such as PISA and TIMSS, where Filipino learners consistently perform below the global average. These results underscore systemic issues within the Philippine educational system. Supporting this observation, [4] reported that Filipino students encounter considerable difficulties in understanding mathematical concepts. Their study identified common challenges such as analyzing problems, comprehend-ing concepts, determining appropriate solution strategies, formulating equations, and simplifying mathematical expressions.

Studies have shown that students frequently experience difficulties in comprehend-ing mathematical tasks and transforming them into mathematical representations, accounting for a substantial proportion of the errors committed during problem-solving [5]. Similarly, errors in comprehension, transformation, process skills, and encoding have been observed among students solving mathematical communication problems [6]. Research has further revealed that weaknesses in mathematical representation, including misinterpretation of information, incorrect formula selection, conceptual mis-understandings, inaccurate solution interpretation, failure to provide conclusions, and computational mistakes, contribute significantly to students' problem-solving errors [7]. Students often apply formulas without first identifying relevant information from the problem and tend to use formulas mechanically without considering the underlying context [8]. Furthermore, learners frequently struggle with multi-step mathematical problems that require deeper conceptual understanding and the effective application of problem-solving strategies [9].

Research on mathematical learning difficulties has demonstrated that inadequate educational conditions may result in 50% to 70% of students being classified as very low achievers despite regular school attendance [10]. These students often exhibit substantial difficulties in understanding mathematical concepts, with failure rates that far exceed the prevalence typically associated with developmental dyscalculia. In

developing countries such as the Philippines, where socioeconomic and political chal-lenges remain prevalent, poor mathematical performance cannot be attributed solely to poverty. Rather, the educational crisis may contribute to conditions that increase students' vulnerability to mathematical learning difficulties, creating circumstances similar to those experienced by learners with developmental dyscalculia.

In the Philippines, the limited body of research on dyscalculia and MLD contin-ues to hinder efforts toward inclusive education, potentially widening learning gaps among junior high school students. Investigating MLD within the context of Palawan is essential for promoting a more inclusive educational system and addressing the spe-cific needs of learners who experience difficulties in mathematics. Error analysis serves as an important diagnostic tool for identifying students' misconceptions and weak-nesses, enabling educators to design targeted interventions and improve mathematical proficiency [11].

1.1 Understanding MLD through Error Analysis

Error analysis plays a crucial role in detecting and mitigating MLD by identifying common errors and misconceptions among students [12]. Through error-analysis activ-ities, students become more aware of their mistakes, leading to improved classroom interactions, enhanced student engagement, and better understanding of mathemati-cal concepts. Studies have shown that error analysis helps in pinpointing specific areas of difficulty such as comprehension, transformation, and encoding stages, allowing for targeted interventions to address these challenges. By utilizing error analysis, educa-tors can tailor

teaching strategies to focus on areas where students struggle the most, ultimately improving learning outcomes and proficiency in mathematics.

1.2 Educators' Perception on Error Analysis

Educators recognize the importance of error analysis in understanding students' learn-ing processes, identifying misconceptions, and improving instructional practices. The effective use of error analysis, which can enhance both classroom interactions and students' conceptual understanding, largely depends on teachers' knowledge of math-ematics and pedagogical approaches [13]. Some educators intentionally incorporate errors into instruction as a teaching strategy to encourage student engagement, stim-ulate critical thinking, and deepen mathematical understanding. However, the use of intentional errors varies depending on instructional objectives, students' proficiency levels, and the context of the lesson [14].

Research indicates that many teachers do not fully utilize errors as opportunities for learning. According to [15], students' mistakes are often corrected without further analysis or discussion, resulting in a perception of mathematics as a rigid subject that emphasizes memorization rather than conceptual understanding. When teachers do not encourage students to reflect on their mistakes, learners are less likely to recognize the sources of their errors or develop strategies to overcome them. Instead, they tend to rely solely on previously taught procedures, limiting the development of critical thinking skills and increasing anxiety about making mistakes. Furthermore, teach-ers' attitudes toward errors play a significant role in shaping the classroom learning

environment. A positive perspective on errors promotes a growth mindset, creating a supportive atmosphere in which students feel comfortable making mistakes, learning from them, and receiving constructive feedback [16].

2 Methodology

2.1 Research Design

This study uses a mixed methods approach, combining quantitative and qualita-tive data collection and analysis. An explanatory sequential design was employed, beginning with quantitative data to identify patterns, followed by qualitative data to explain and elaborate on these findings. The quantitative phase utilized a descrip-tive approach to categorize students' errors and applied inferential statistics (one-way ANOVA) to assess demographic differences in mathematical errors. In the qualita-tive phase, a Focus Group Discussion (FGD) with five participants was conducted to explore students' reasoning and misconceptions. Explanatory interviews further inves-tigated students' problem-solving strategies and their impact on mathematical errors, providing a comprehensive understanding of the research topic.

2.2 Participants, Data Collection, and Instruments

This study employed purposive sampling, selecting 77 Junior High School students from Palawan during the 2023–2024 academic year. Schools were chosen based on their rural or urban locations, accessibility, and willingness to participate, with San Jose National High School and Macarascas National High School included. Participants were seventh graders identified by teachers as having MLD and who consented to join the research. After administering the Mathematics Error Pattern Identification Test (MEPIT), five students—two with the fewest errors and three with the most—were selected for follow-up FGD, which maintained strict confidentiality.

Data collection included demographic information (gender, and school type) to support statistical analysis. The primary tool, MEPIT—developed by [31]—consisted of 64 math problem-solving tasks. This test, validated for both reliability and cul-tural relevance, was administered in two phases and contextualized for Palawan's student population. Additionally, semi-structured FGDs provided deeper insights into participants' problem-solving strategies.

3 Data Analysis and Results

Table 1 presents the frequencies and structures of mathematical errors committed by students with mathematical learning difficulties. The results reveal that presentation errors obtained the highest percentage (94.03%), indicating a very high occurrence among participants. This finding suggests that students frequently experience diffi-culties in expressing mathematical solutions using appropriate symbols, notations, diagrams, or written representations. Similarly, transformation errors (81.23%) were classified as very high, indicating that many students struggled to translate verbal or contextual problems into appropriate mathematical expressions and equations.

Table 1 Frequencies and Structures of Mathematical Errors

Types of Error	Maximum Potential Error	Mean Frequency	Percentage(%)	Error Level
Visual-spatial Error	20	6.13	30.95	Low
Comprehension Error	11	8.28	75.32	High
Transformation Error	11	8.93	81.23	Very High
Relevance Error	10	7.31	73.12	High
Fact Error	17	11.87	69.82	High
Procedural Error	12	8.36	69.70	High
Measurement Error	11	8.34	75.80	High
Presentation Error	15	14.10	94.03	Very High

Comprehension errors (75.32%), measurement errors (75.80%), and relevance errors (73.12%) were all classified as high. These findings suggest that students encounter considerable difficulties in understanding problem statements, interpreting measurements accurately, and identifying relevant information needed to solve math-ematical problems. Fact errors (69.82%) and procedural errors (69.70%) were likewise observed at high levels, indicating weaknesses in recalling mathematical facts and applying appropriate solution procedures.

In contrast, visual-spatial errors recorded the lowest percentage (30.95%), which was classified as low. Although less prevalent than the other error types, this result sug-gests that some students still encounter challenges in interpreting spatial relationships, geometric figures, and visual representations of mathematical concepts.

The prevalence of comprehension errors supports the findings of [17], who empha-sized that difficulties in understanding mathematical concepts often contribute to persistent errors among learners with mathematical difficulties. Likewise, the very high incidence of transformation errors is consistent with the findings of [18], which highlighted students' challenges in converting verbal statements into mathematical representations and arguments. The occurrence of relevance and fact errors aligns with the findings of [19], suggesting that misconceptions and difficulties in applying mathematical knowledge can hinder effective problem solving.

Furthermore, the high levels of procedural and measurement errors corroborate the findings of [12], who reported that students with mathematical learning difficulties frequently struggle with executing procedures correctly and performing calculations accurately. The exceptionally high percentage of presentation errors underscores the importance of developing students' mathematical communication and representa-tion skills. These findings suggest the need for targeted instructional interventions that address students' weaknesses in understanding, transforming, representing, and communicating mathematical ideas to improve overall mathematical performance.

Table 2 presents the relationship between types of mathematical errors and gender. The findings indicate a statistically significant difference in visual-spatial errors between male and female students. Male students obtained a higher mean score (M = 7.15, SD = 4.597) than female students (M = 5.08, SD = 4.174), with a significant t-test result (t = 2.072, p = 0.042). The effect size (Cohen's d = 0.472) suggests a moderate practical difference between the two groups. This finding supports

Table 2 Relationship of Type of Error and Gender

2-7 Types of Error	Male		Female		Sig. Level (t-test)		Effect Size
	Mean	SD	Mean	SD	*t*	*p*	(Cohen's d)
Visual-spatial Error	7.15	4.597	5.08	4.174	2.072	0.042*	0.472
Comprehension Error	8.46	2.138	8.11	2.128	0.733	0.466	
Transformation Error	8.97	1.912	8.89	2.141	0.172	0.846	
Relevance Error	7.54	2.199	7.08	1.964	0.966	0.337	
Fact Error	12.10	2.664	11.63	2.624	0.781	0.437	
Procedural Error	8.44	1.984	8.29	2.180	0.308	0.759	
Measurement Error	8.46	2.469	8.21	1.663	0.524	0.602	
Presentation Error	14.26	1.251	13.95	1.902	0.844	0.401	

n = 77 (Male=39, Female=38), *p < 0.05

the study of [20], which identified visuospatial working memory as a common area of difficulty among students with mathematical learning disabilities. The higher occur-rence of visual-spatial errors among male students may be associated with challenges in interpreting spatial relationships, visual representations, and geometric concepts.

No statistically significant gender differences were observed in comprehension, transformation, relevance, fact, procedural, measurement, and presentation errors, as all obtained *p*-values greater than 0.05. These findings suggest that male and female students experience similar difficulties across most mathematical error categories. This result is consistent with the findings of [8], who reported that errors related to math-ematical representations and problem-solving processes occur across different student groups regardless of gender. Similarly, [4] emphasized that difficulties in understand-ing mathematical concepts, identifying appropriate solution strategies, and solving mathematical problems are experienced by both male and female learners.

The presence of a significant gender difference only in visual-spatial errors suggests that gender may influence specific cognitive processes related to spatial reasoning, but not other aspects of mathematical performance. Consequently, interventions should focus on addressing students' specific learning needs rather than relying on gender-based assumptions. According to [21], students with mathematical learning difficulties exhibit diverse cognitive profiles and require individualized instructional approaches to address their particular weaknesses. Furthermore, the findings support those of [11], who observed that misconceptions and mathematical errors are often shared among learners regardless of demographic characteristics or learning environments.

Teachers play a critical role in helping students overcome mathematical errors. Research by [13] emphasizes the importance of teachers' knowledge and effective use of error analysis in identifying misconceptions and guiding learning. Likewise, [16] high-lighted that positive teacher attitudes toward mistakes can foster a growth mindset, encouraging students to learn from their errors and develop stronger mathematical problem-solving skills.

Table 3 presents the relationship between types of mathematical errors and type of school. The results indicate a statistically significant difference only in transformation errors between students from urban

and rural schools. Rural students obtained a higher mean score (*M* = 9.48, *SD* = 1.377) than urban students (*M* = 8.35, *SD* = 2.418),

Table 3 Relationship of Type of Error and Type of School

2-7 Types of Error	Urban		Rural		Sig. Level (t-test)		Effect Size (Cohen's d)
	Mean	SD	Mean	SD	*t*	*p*	
Visual-spatial Error	6.49	4.857	5.80	4.152	0.668	0.506	
Comprehension Error	7.95	2.549	8.60	1.614	-1.356	0.188	
Transformation Error	8.35	2.418	9.48	1.377	-2.479	0.016*	-0.577
Relevance Error	7.05	2.356	7.55	1.797	-1.043	0.300	
Fact Error	11.97	2.977	11.78	2.315	0.327	0.744	
Procedural Error	8.35	2.239	8.38	1.931	-0.050	0.960	
Measurement Error	8.27	2.376	8.40	1.837	-0.269	0.789	
Presentation Error	13.97	1.893	14.23	1.291	-0.687	0.494	

$n = 77$ (Urban=37, Rural=40), $^*p < 0.05$

with a significant t-test result ($t = -2.479$, $p = 0.016$). The effect size (Cohen's $d = -0.577$) suggests a moderate practical difference between the two groups. This finding implies that students from rural schools experience greater difficulty in transforming verbal statements, mathematical situations, or contextual information into appropriate mathematical representations and equations. Similar findings were reported by [6] and [4], who observed that difficulties in problem representation and mathematical transformation are often associated with limited exposure to effective problem-solving strategies and instructional resources.

No statistically significant differences were found in visual-spatial, comprehension, relevance, fact, procedural, measurement, and presentation errors, as all obtained *p*-values greater than 0.05. These findings suggest that students with Mathematical Learning Difficulties (MLD) experience similar challenges regardless of whether they attend urban or rural schools. This result is consistent with the findings of [22], who reported that mathematical learning difficulties are influenced by cognitive factors that transcend geographical location and school setting.

Similarly, visual-spatial errors did not differ significantly between urban and rural students, indicating that difficulties related to spatial reasoning, visualization, and geometric understanding are common among students with mathematical learning difficulties across different educational environments. This finding supports the work of [20], who emphasized the role of visuospatial working memory deficits in students' mathematical performance.

Although most mathematical error types were comparable across school types, the significantly higher transformation errors among rural students highlight the need for targeted instructional interventions. Strategies such as explicit problem-solving instruction, metacognitive training, and the use of visual representations may help students develop stronger mathematical reasoning and transformation skills. These recommendations are supported by [9], who found that metacognitive approaches can significantly improve students' ability to analyze, represent, and solve mathematical problems effectively.

Figure 1 illustrates students' problem-solving strategies for basic arithmetic oper-ations. The addition problem (62 + 25) had a low error rate of 6.49%, whereas the multiplication problem (23 × 45) exhibited a high error rate of 74.03%. This contrast suggests that students generally understand simpler arithmetic operations but experience considerable difficulty when solving more complex operations such as multiplication.

This finding is consistent with the study of [21], which reported that students with Mathematical Learning Difficulties (MLD) frequently encounter challenges in perform-ing multi-step operations that require abstract reasoning and procedural manipulation. Likewise, [23] emphasized that inattentiveness often contributes to repeated compu-tational errors because of weaknesses in foundational mathematical knowledge. The high frequency of multiplication errors observed in this study may therefore indicate deficiencies in procedural fluency and conceptual understanding.

Furthermore, [4] noted that students often struggle to transform mathematical concepts into appropriate procedural steps, which may contribute to errors in multi-plication and other multi-step computations. These findings highlight the importance of implementing targeted instructional interventions that strengthen both conceptual and procedural understanding. The use of visual representations, scaffolding tech-niques, and explicit step-by-step instruction has been shown to support students' mathematical learning and improve problem-solving performance [5, 9].

Figure 2 presents common mathematical errors committed by students, particu-larly in tasks involving number comparison, fraction addition, time reading, and area measurement. These errors reflect difficulties in understanding fundamental math-ematical concepts and applying appropriate problem-solving strategies. The figure provides evidence of students' misconceptions and procedural weaknesses, which may hinder their mathematical performance.

According to [4], students' difficulties often arise from misconceptions involv-ing abstract mathematical concepts. Errors such as incorrectly comparing numbers, misadding fractions, or misreading clocks indicate weaknesses in understanding real numbers, proportional reasoning, and measurement concepts. Frequent formative assessments and individualized feedback can help identify and address these miscon-ceptions, thereby improving students' conceptual understanding and mathematical performance.

Similarly, [5] suggested that applied problem-solving experiences in game-based learning environments can help bridge learning gaps by enabling students to visual-ize abstract concepts and develop stronger mathematical reasoning skills. Interactive learning experiences may therefore improve students' understanding of concepts such as area measurement and time interpretation.

The findings are also supported by [6], who emphasized Newman's Error Analysis framework and found that many mathematical errors arise from misreading, mis-understanding, or misinterpreting problem requirements. Common errors in number comparison, fraction operations, and area measurement may therefore result from students' inability to comprehend the task accurately before attempting a solution.

Furthermore, [7] highlighted the importance of mathematical representation skills, noting that students' ability to interpret visual and symbolic representations plays a critical role in solving problems involving fractions, decimals, and geometry. The errors observed in area measurement and number comparison suggest the need for instruc-tional approaches that promote multiple representations of mathematical concepts and strengthen students' representational abilities.

Moreover, [9] argued that students who possess strong metacognitive skills are better able to monitor, evaluate, and correct their own thinking processes. Encouraging learners to reflect on their reasoning and solution strategies may therefore reduce the frequency of errors illustrated in Figure 2.

Error analysis has also been identified as an effective strategy for addressing misconceptions and preventing recurring mistakes. According to [11], encouraging stu-dents to analyze and reflect on their errors promotes deeper learning and conceptual understanding. Reflection enables learners to identify misconceptions, revise incorrect strategies, and develop more effective approaches to mathematical problem solving.

Finally, [24] emphasized the role of executive functioning in mathematical perfor-mance, suggesting that difficulties in visuospatial working memory, attention control, and numerical processing may contribute to many of the errors observed in these tasks. The errors presented in Figure 2 may therefore reflect underlying cognitive chal-lenges that affect students' ability to process mathematical information accurately and efficiently.

4 Key Challenges in Learning Mathematics Among Students

The thematic analysis revealed that students encounter several challenges in learning mathematics, primarily related to retaining fundamental concepts, performing alge-braic manipulations, and applying mathematical formulas to solve practical problems. These difficulties suggest persistent gaps in conceptual understanding that hinder stu-dents' ability to progress toward more advanced mathematical topics. Similar findings were reported by [4], who found that deficiencies in foundational mathematical knowl-edge often intensify difficulties in higher-level concepts, particularly algebra. As a result, many students become dependent on external assistance from peers, teachers, or family members when completing mathematical tasks. Likewise, [6] identified proce-dural errors and difficulties in recognizing relevant information within word problems as major barriers to successful problem solving. These findings support the argument of [10], who emphasized that inadequate intervention during the early stages of math-ematical learning may contribute to persistent difficulties that continue throughout students' educational experiences.

Another significant challenge identified in this study involves the application of mathematical knowledge to real-world situations. Many students expressed difficulty in connecting abstract mathematical concepts and formulas to practical contexts, lim-iting their ability to solve authentic problems effectively. This finding is consistent with [5], who noted that learners frequently experience confusion when attempting to apply mathematical principles beyond classroom exercises. Such difficulties may stem

from limited opportunities to engage in contextualized and meaningful mathe-matical experiences during earlier stages of learning. Furthermore, [21] argued that students with Mathematical Learning Difficulties (MLD) often struggle to bridge the gap between theoretical understanding and practical problem solving, making the transfer of knowledge particularly challenging.

The findings also highlight the importance of developing multiple forms of math-ematical representation to strengthen conceptual understanding. According to [8], fostering students' ability to represent mathematical ideas through visual, symbolic,

verbal, and numerical forms can improve problem-solving performance and conceptual comprehension. By utilizing multiple representations, students may better visual-ize relationships among mathematical concepts and apply them more effectively in different contexts. Consequently, the findings suggest that instructional approaches emphasizing hands-on activities, contextualized learning experiences, and multiple representations may help address the underlying causes of students' difficulties in mathematics and improve their overall mathematical proficiency.

5 Conclusions and Recommendations

This study examined the mathematical error patterns and problem-solving strategies of junior high school students with Mathematical Learning Difficulties (MLD) in Palawan. The findings revealed that students commonly experience difficulties in com-prehension, transformation, and presentation of mathematical problems. Among the identified error types, transformation errors (81.23%) and presentation errors (94.03%) recorded the highest occurrence, indicating that students struggle to translate problem situations into appropriate mathematical representations and communicate solutions accurately. Furthermore, rural students demonstrated significantly higher transfor-mation errors than their urban counterparts, suggesting disparities in instructional experiences and learning resources. Gender differences were also observed, with male students exhibiting significantly higher visual-spatial errors than female students.

The qualitative findings further reinforced the quantitative results. Students fre-quently reported difficulties in recalling basic mathematical concepts, solving word problems, performing algebraic manipulations, and using measurement tools effec-tively. These challenges contributed to high levels of procedural, measurement, and
transformation errors. The findings suggest that weaknesses in foundational mathe-matical knowledge, conceptual understanding, and problem-solving skills continue to impede students' mathematical performance.

The results underscore the need for targeted educational interventions to address the unique learning needs of students with MLD. The challenges identified in this study reflect broader concerns regarding mathematics education in the Philippines, particularly in light of the country's continued underperformance in international
assessments such as PISA and TIMSS. Moreover, the limited attention given to Mathe-

matical Learning Difficulties within the Philippine educational context may contribute to persistent achievement gaps among learners.

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

1. **Strengthen Professional Development Programs for Teachers.** Educa-tional institutions and school administrators should provide continuous professional development programs focusing on error analysis, differentiated instruction, inclu-sive teaching practices, and intervention strategies for students with Mathematical Learning Difficulties. Enhancing teachers' capacity to identify and address spe-cific mathematical errors can improve students' conceptual understanding and problem-solving abilities.

2. **Promote Equitable Access to Learning Resources.** Additional support should be provided to rural schools through the distribution of instructional materials, manipulatives, visual aids, and technology-enhanced learning tools.
   Ensuring equitable access to educational resources may help reduce disparities in mathematical performance between urban and rural learners.
3. **Integrate Metacognitive and Visual Learning Strategies.** Mathematics
   instruction should incorporate metacognitive approaches that encourage students to monitor, evaluate, and reflect on their problem-solving processes. The use of
   visual representations, diagrams, graphic organizers, and concrete materials may also strengthen students' conceptual understanding and spatial reasoning skills.
4. **Implement Personalized and Inclusive Learning Interventions.** Schools
   should develop individualized support programs that address the specific learning
   needs of students with MLD. Interventions should focus on strengthening founda-tional mathematical concepts while gradually developing higher-order thinking and problem-solving skills.
5. **Encourage Early Identification and Intervention.** Early screening and assess-
   ment procedures should be established to identify learners who exhibit persistent mathematical difficulties. Timely intervention can prevent the accumulation of learning gaps and promote better long-term academic outcomes.
6. **Conduct Further Research on Mathematical Learning Difficulties.** Future studies may explore intervention programs, instructional models, and assistive tech-nologies that effectively support students with MLD. Expanding research in this area will contribute to the development of evidence-based practices and policies that promote inclusive mathematics education in the Philippines.

In conclusion, addressing the mathematical difficulties experienced by junior high school students requires collaborative efforts among educators, school leaders, families, and policymakers. Through targeted interventions, inclusive instructional practices, and equitable educational opportunities, students with Mathematical Learning Diffi-culties can be better supported in developing the mathematical competencies necessary for academic success and lifelong learning.

Declarations

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Ethics Approval and Consent to Participate

This study was reviewed and approved by the Ethics Review Committee of Central Luzon State University. Permission to conduct the study was also obtained from the Department of Education – Schools Division of Puerto Princesa City and the partici-
pating schools. Participation in the study was voluntary. Written informed consent was obtained from participants and/or their parents or legal guardians, where required, prior to data collection. All procedures performed in this study were conducted in accordance with applicable ethical standards and institutional guidelines.

Consent for Publication

Consent for publication was obtained from the participants, participating teach-ers, and school authorities. All identifying information was removed to ensure the
confidentiality and anonymity of the individuals and institutions involved in the study.

Data Availability

The datasets generated and/or analyzed during the current study are not publicly available due to confidentiality and privacy restrictions involving student participants but are available from the corresponding author on reasonable request.

Author Contributions

P.J.N.C.C. conceptualized the study, conducted the data collection and analysis, inter-
preted the findings, prepared the figures and tables, and wrote the main manuscript
text. E.I. supervised the research, provided academic guidance throughout the study,
critically reviewed and revised the manuscript, and contributed to the interpretation of the findings. All authors reviewed and approved the final manuscript.

Competing Interests

The authors declare that they have no competing interests. An earlier version of this manuscript was submitted for consideration in the AIP Conference Proceedings but was subsequently withdrawn due to

administrative issues related to author contact information. The manuscript was not published in the conference proceedings.

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Figures

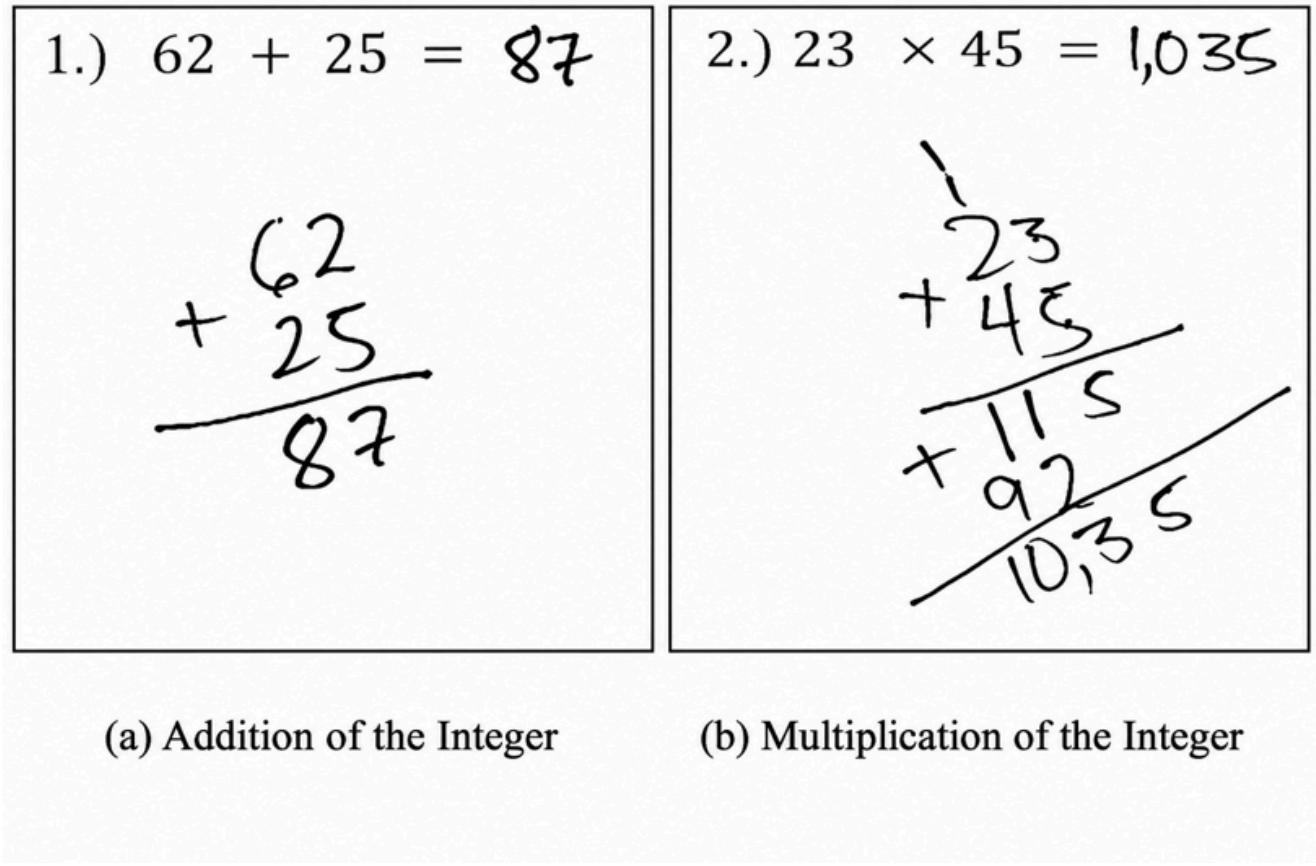


Figure 1

Integer Operation

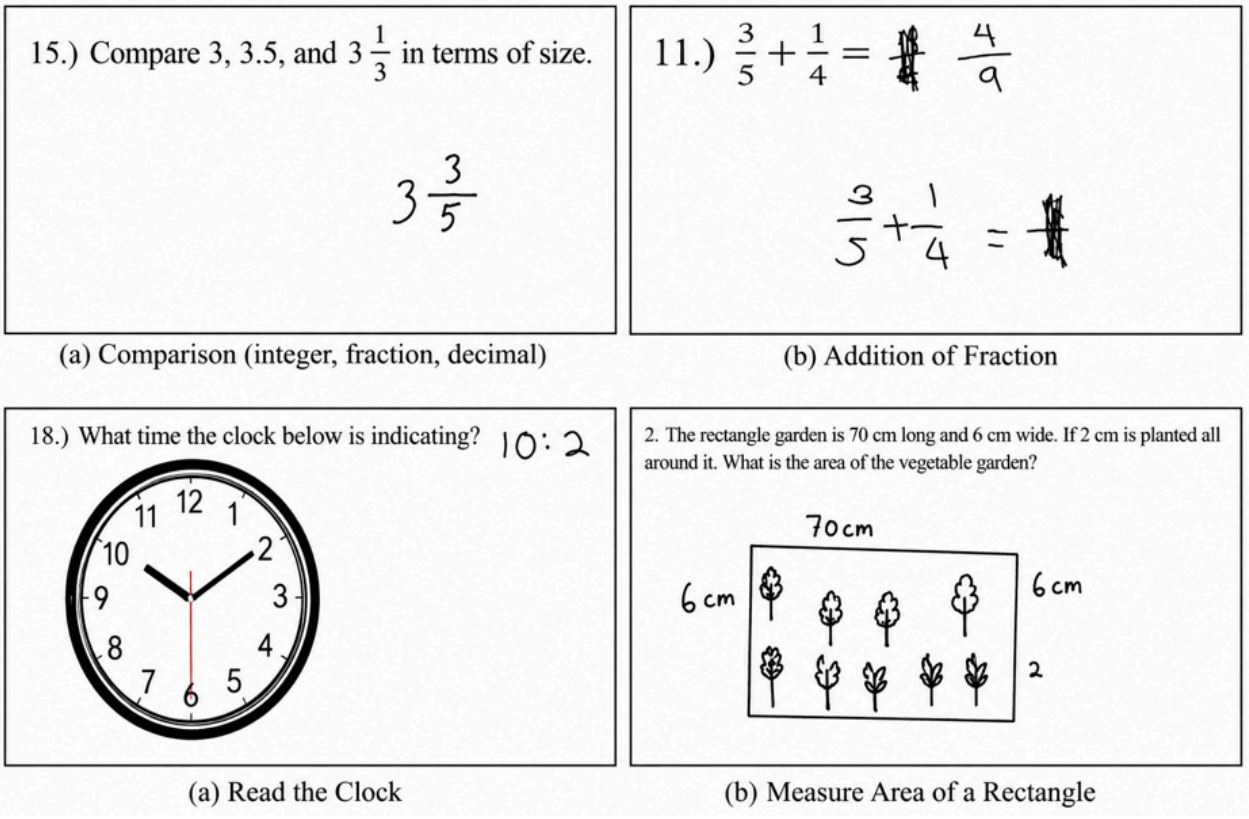


Figure 2

Common Errors