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Analyzing Students' Numeracy Skills in Personal Context Problems: A Study of the Minimum Competency Assessment (MCA)

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Abstract

This study addresses the gap in understanding how personal context influences students' numeracy skills, particularly in the context of the Minimum Competency Assessment (MCA) in Indonesia. The research problem centers on the challenge of engaging students with numeracy tasks that are not only mathematically relevant but also relatable to their personal experiences. While the MCA assesses mathematical reasoning and problem-solving, students often struggle to apply these skills to real-world scenarios, particularly when the context of the problems is unfamiliar or disconnected from their daily lives. This study aims to analyze the numeracy skills of eighth-grade students in solving problems with a personal context within the Minimum Competency Assessment (MCA). The study employed a mixed-methods design, integrating both quantitative and qualitative data. Quantitative data were analyzed using content validity analysis (Aiken's V) and inter-rater reliability (Cohen's Kappa) to assess the validity and consistency of the MCA questions. Descriptive statistics were used to analyze the students' numeracy scores. For qualitative analysis, semi-structured interviews were conducted to explore students' reasoning and problem-solving strategies. The triangulation of data from the MCA tests and interviews provided a comprehensive understanding of how students engaged with mathematical problems and applied their numeracy skills in real-world contexts. A total of 17 eighth-grade students were selected, and three students from each numeracy category; high, medium, and low were chosen using a categorization method based on standard deviation. Results showed that students with high numeracy abilities demonstrated effective problem-solving and reasoning skills, while medium and low numeracy students struggled with complex problems and real-world application. The study suggests that while personal context can enhance student engagement, its effectiveness depends on a solid foundation in numeracy skills. The findings recommend a balanced approach in teaching, strengthening foundational skills alongside contextualized learning. In conclusion, while the personal context in MCA increases student engagement and relevance, particularly among high-performing students, its effectiveness is contingent on a solid foundation in basic numeracy skills. A balanced approach that strengthens basic numeracy skills while incorporating personal contexts is necessary to foster critical thinking and effective application of mathematics across all ability levels.

Keywords: Numeracy Skills; Minimum Competency Assessment; Personal Context

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INTRODUCTION

Numeracy is a fundamental skill in education, essential for academic success and everyday problem-solving. It involves the capacity to comprehend and use numbers, which is essential for making well-informed decisions in civic, professional, and personal contexts. Over time, the idea of numeracy has changed, with a greater focus on its evaluative and critical components. Recent developments in numeracy education emphasize a critical approach, which involves not just mathematical competence but also the ability to evaluate and make decisions. This critical turn is seen as essential for responsible citizenship and addressing societal challenges such as the COVID-19 pandemic. It ensures that numeracy education remains relevant in a rapidly changing world (Geiger & Schmid, 2024). Numeracy is linked to superior decision-making and life outcomes, including higher income and life satisfaction (Bjälkebring & Peters, 2021). Recent research emphasizes the importance of early numeracy skills, including counting, number relations, and basic arithmetic, as foundational for later mathematical outcomes (Devlin et al., 2022). Although numeracy is a primary goal of mathematics education, it is challenging to teach and cannot be assumed through classroom learning alone. Effective numeracy education demands specific strategies and resources (Adelia et al., 2024). Moreover, numeracy is deeply intertwined with cultural practices in daily life (Marhami et al., 2023), and the numeracy skills gained in elementary education form the foundation for later competencies (Nuraini & Humaidi, 2020). Students with strong numeracy skills can apply mathematical concepts more effectively, leading to improved outcomes in problem-solving tasks (Nahdi et al., 2020). Today, numeracy is increasingly regarded as a form of critical thinking, requiring more than just manipulating numbers. It involves critically evaluating information in both real-world contexts and academic settings (Jain & Rogers, 2019; Nasruddin & Jahring, 2024). Numeracy is an essential skill that not only supports academic success but also plays a pivotal role in shaping life outcomes and contributing to responsible citizenship. Numeracy, based on critical thinking, is essential for equipping individuals to face future challenges.

The Minimum Competency Assessment (MCA) is a critical tool for assessing the fundamental literacy and numeracy abilities that are necessary for students' cognitive growth and engagement in society. It replaces Indonesia's National Examination, concentrating on evaluating students' ability to reason within real-life contexts. The MCA assesses fundamental literacy and numeracy abilities, which are necessary for students to contribute to society and get ready for the challenges of the twenty-first century. It assesses students' comprehension of fundamental mathematical concepts and reading literacy, which encompasses critical thinking and reasoning (Hidayah et al., 2021; Megawati & Sutarto, 2021). The introduction of the MCA is designed to enhance the quality of education, which have been areas of weakness for Indonesian students in international assessments such as PISA and TIMSS (Hidayah et al., 2021; Megawati & Sutarto, 2021; Mellyzar et al., 2023). MCA questions are designed to be valid and practical, focusing on content, cognitive processes, and context. The content areas include algebra, numbers, geometry and measurements, and data and uncertainty. MCA include multiple-choice and complex questions that require evidence-based reasoning (Afrina et al., 2023; Amelia et al., 2023; Syaifuddin, 2022). By shifting away from the traditional National Examination and emphasizing real-world problem-solving and critical thinking, MCA provides a more relevant and practical approach to assessing students' readiness for the challenges of the modern world.

According to (Kemendikbud, 2021), numeracy assessments are grounded in both cognitive processes and contextual factors. Cognitive processes involve the comprehension of concepts, which are then applied to reasoning when solving problems. Contextually, numeracy assessments consider personal, socio-cultural, and scientific contexts to evaluate students' abilities. Personal contexts allow students to connect the assessment to their daily lives. This relevance is vital for motivating students and ensuring that the skills being assessed are useful in real-world situations (Afrina et al., 2023). By incorporating personal contexts, the MCA encourages the development of critical thinking and problem-solving skills. Students are prompted to apply their knowledge to situations they might encounter outside the classroom, fostering a deeper understanding of the material (Inganah et al., 2023). In this study, the researcher will focus on the personal context, as it is closely linked to the students' immediate surroundings. Personalizing real-world problems by aligning them with students' personal experiences or environments can increase motivation and engagement (Schoenherr, 2024). Using personal contexts helps students master mathematical facts, concepts, and tools, which are crucial for solving everyday problems (Tsaqifah et al., 2024).

Students' numeracy skills are often categorized as high, medium, or low, with many students falling into the lower categories. This is evident across different grade levels and subjects, such as algebra (Astriani & Akyuni, 2024; Tresnasih et al., 2022). Many students struggle with applying critical thinking to numeracy problems, especially in domains like geometry and data interpretation (Lubis & Permatasari, 2023). Students face difficulties in understanding concepts, skills, and problem-solving, particularly in areas like fractions and algebra (Lestari et al., 2023). This is because students often lack experience with MCA-type questions, which affects their performance (Susanto et al., 2023). Mastering the basics of algebra and geometry is crucial for several reasons. Algebra serves as the language of mathematical relationships, it allows students to model real-world scenarios, recognize patterns, and build the abstract reasoning required for higher-level mathematics and the sciences (NCTM, 2017). A robust foundation in algebra is essential for translating real-life situations into mathematical expressions, a critical skill in problem-solving and decision-making processes (Stephens et al., 2017). On the other hand, geometry underpins our understanding of spatial relationships and measurement. Its concepts are not merely theoretical; they are directly applicable to tasks such as calculating areas, designing structures, and visualizing space, which are pertinent in everyday life (K. P. E. Gravemeijer et al., 2016; Seah, 2018). In this study, the researchers specifically chose to focus on algebraic and geometric problems. This choice was made because these domains represent the fundamental structures of mathematics that frequently manifest in personal contexts. Algebraic problems are used to assess students' skills in identifying variables, establishing relationships, and systematically resolving equations, abilities that are vital for making informed decisions in financial, planning, and resource management situations. Geometric problems, meanwhile, evaluate students' spatial reasoning and measurement capabilities, which are important for practical tasks like determining areas and understanding the physical dimensions of objects.

Numeracy skills were crucial for students' academic success and real-life problem-solving. The Minimum Competency Assessment (MCA) served as a benchmark for evaluating numeracy in Indonesia, but it often presented challenges to students, particularly in how they applied mathematical reasoning to real-world scenarios. Previous research (Lubis & Permatasari, 2023; Tsaqifah et al., 2024) largely focused on students' ability to perform basic mathematical operations but paid less attention to how personal real-life contexts influenced their performance in assessments like the MCA. Although real-world context was recognized as essential in enhancing student engagement, few studies explored how personal contexts specifically affected students' ability to engage with and solve MCA problems. While some studies, such as (Tsaqifah et al., 2024), explored numeracy in MCA, they did not address the role of personal context in problem-solving, particularly in tasks involving algebra and geometry. The gap in the literature lay in understanding how contextualized problems in MCA impacted students at different numeracy levels. Previous studies generally treated context as a broad element but did not examine its specific impact on numeracy tasks based on personal relevance. This study intended to fill this gap by investigating how personal real-life contexts in algebra and geometry problems affected the numeracy performance of eighth-grade students.

Although there was increasing interest in the integration of personal contexts in numeracy assessments (Tsaqifah et al., 2024), this study presented several novel elements. Firstly, it employed a mixed-methods design, triangulating data from MCA test responses and student interviews to provide deeper insight into how students' numeracy abilities were influenced. This combination allowed for a deeper analysis of how personal context influenced numeracy across different ability levels. Secondly, this study introduced a unique coding strategy for analyzing students' written responses, which offered a more systematic way of evaluating how personal contexts were understood and applied by students in real-world problem scenarios. Finally, this research examined how triangulation of data contributed to a more comprehensive understanding of students' problem-solving processes, providing insights into teaching practices that could be adapted for diverse learner profiles. The main research question addressed in this study was; how did the personal context influence numeracy skills across students with different numeracy levels? By filling this gap, the study aimed to analyze eighth-grade students' numeracy skills in solving problems with personal contexts in the Minimum Competency Assessment (MCA). The findings from this study were expected to contribute to a deeper understanding of how personal context could enhance numeracy assessments and provide valuable insights for improving instructional strategies tailored to students' diverse numeracy abilities.

METHOD

Research Design

This study utilized a mixed-method design, combining both quantitative and qualitative approaches. The objective of the study was to analyze eighth-grade students' numeracy skills in solving problems with personal contexts in the Minimum Competency Assessment (MCA). The data collection technique used in this study included MCA tests and semi-structured interviews.

Instrument and Procedure

The instruments used in this research are numeracy MCA tests adopted from the Ministry of Education and Culture (Kemendikbud) and an interview guide. The content of the MCA questions includes algebra, and geometry and measurement. Each content area consists of one question. The two selected questions consisted of complex multiple-choice and multiple-choice question. The quantitative data collected in this study included content validity measured using Aiken's V for the algebra and geometry questions, as well as the interview guide (Aiken, 1985). Additionally, inter-rater reliability was assessed using Cohen's Kappa for the algebra and geometry questions (Cohen, 1960). The quantitative data were analyzed using SPSS 22 to evaluate the validity and reliability of the assessment instruments. The qualitative data consisted of student responses to the algebra and geometry questions, as well as the results of the interviews conducted to understand how students solved numeracy problems in the MCA. Figure 1 showed the algebra and geometry problems used in this study.

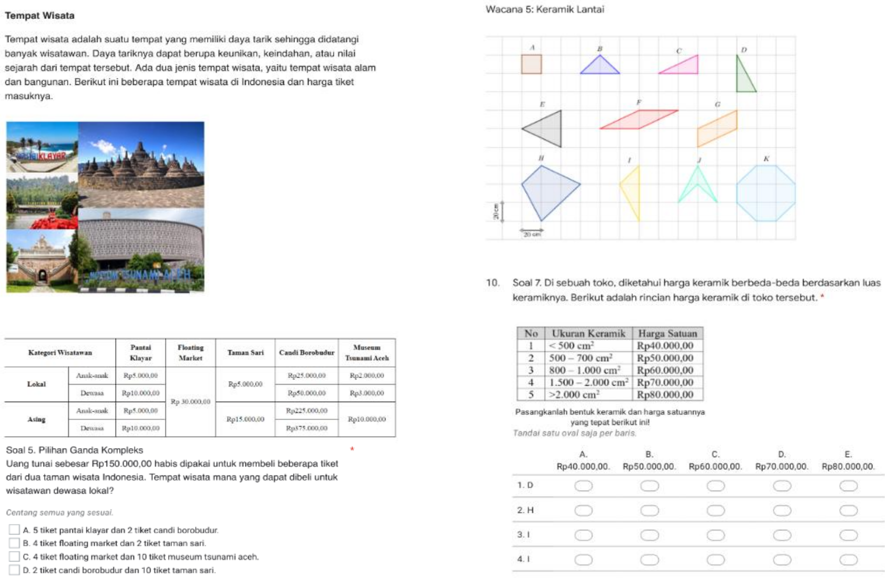

Figure 1. Algebra and Geometry Questions

The numeracy skills of students examined in this study use the numeracy indicators proposed by (Han et al., 2017). These indicators are provided in the following Table 1.

Table 1. Numeracy Indicators (Han et al., 2017)

No	Indicators	Code
1	Able to use various types of numbers or symbols related to basic mathematics in solving daily life problems.	NU1
2	Able to analyze information displayed in various forms (graphs, tables, charts, diagrams, etc.)	NU2
3	Interpret the results of the analysis to predict and make decisions.	NU3

The interview questions were structured based on the numeracy indicators. These indicators were carefully selected to ensure that the questions align with the research objectives and effectively assess the intended constructs. Each question was designed to evaluate specific aspects of numeracy, which are key elements in the context of the study. By aligning the interview questions with these numeracy indicators, the interview guide aimed to capture relevant data for the research. The validity of the interview guide was then assessed using content validity through Aiken's V (Aiken, 1985), which was evaluated by two experts in the field. The experts provided their judgments on the relevance of each question, and the Aiken's V statistic was used to calculate the degree of agreement between them. The interview guide that was developed by the researcher can be seen in Table 2.

Table 2. Interview Guide

No	Indicators	Interview Question
1	Ability to use various types of numbers or symbols related to mathematics to solve everyday problems	a. How do you use mathematical symbols and operations in solving this problem? b. Could you explain the steps you followed to solve this calculation? c. What is the first step you take when working on this type of problem?
2	Ability to analyze information presented in various formats (tables, graphs, diagrams)	a. What key information stands out to you when you look at the data presented in this table or graph? b. How do you identify patterns or trends from the data presented? c. What steps do you take to solve problems based on this data?
3	Ability to interpret results and make predictions based on the analysis	a. After analyzing the data, how do you interpret the results? b. When making decisions, what steps do you take to ensure that the answers are valid and reliable?

Research Sample/Subject

The research was conducted in a junior high school located in Central Aceh. The student sample consisted of 17 eighth-grade students of junior high school. In terms of demographics, the students were aged 13 years. The sample included 8 males and 9 females. Additionally, the school is located in a rural area. The selection of the school was based on factors of accessibility and practical considerations that were important for the smooth collection of data. The school's location, which was relatively easy to access, allowed the researcher to carry out the study efficiently, reducing logistical challenges, and facilitating communication and coordination with the school. Furthermore, the researcher then divided these 17 students into groups based on their numeracy abilities; high, medium, and low. The scoring guide was developed by the researcher, with a total score of 7-8 categorized as high, a score of 4-6 categorized as medium, and a score of 0-3 categorized as low. The grouping was done using the standard deviation method according to (Arikunto, 2008) with the following criteria:

Table 3. Categorization of ability levels

Category	Grouping Formula
High	$X \geq \bar{X} + SD$
Medium	$(\bar{X} - SD) \leq X < (\bar{X} + SD)$
Low	$X < (\bar{X} - S)$

Where:
X = Total score of the student
$\bar{X}$ = Average total score across all students
SD = Measure of how much the scores deviate from the mean

Data Analysis and Coding Procedures for Numeracy Assessment

After the grouping, the researcher selected one student from each category to be interviewed, resulting in 3 subjects being interviewed. The analysis of data from the numeracy test is a detailed and in-depth process that includes coding responses, interpreting the results, using triangulation for verification, and drawing conclusions based on the findings. In addition to this, a codebook was developed to provide a clear and consistent system for applying the codes to the students' responses. The codebook defined each of the numeracy indicators (NU1, NU2, NU3) and provided specific criteria for coding responses. The NU1 indicator focused on students' ability to use mathematical symbols and operations to solve problems. The codebook defined this as any response where students demonstrated an understanding of basic mathematical operations such as addition, subtraction, multiplication, and division. A sample coded response for NU1 could be a student explaining how they used addition and subtraction to solve a word problem. Similarly, for NU2, which focused on students' ability to analyze data presented in tables or graphs, the codebook specified that responses demonstrating the ability to identify trends, make comparisons, or summarize data should be coded as NU2. For example, a student explaining how they analyzed a graph showing the increase in prices over time would be coded as NU2. For NU3, which assessed students' ability to interpret results and make predictions, the codebook specified that responses showing logical reasoning, the ability to infer outcomes based on data, or making predictions about future trends should be classified as NU3. An example of a coded response under NU3 could be a student explaining how they predicted future sales based on trends observed in a dataset.

The coding framework also took into consideration subjects with high numeracy ability (HN), medium numeracy ability (MN), and low numeracy ability (LN). The findings from the subjects' responses are then thoroughly analyzed, with an emphasis on analyzing eighth-grade students' ability to solve MCA problems set in personal contexts and exploring how personal context influences their numeracy performance. Triangulation is conducted by comparing results from different sources or viewpoints to verify consistency and validity. In this study, the researcher applied methodological triangulation (Creswell & Creswell, 2018), which involves utilizing multiple data collection methods to assess the validity of the research findings. Specifically, the researcher employed both tests and interviews.

RESULTS AND DISCUSSION

The results of this mixed-method study are presented in two main phases: quantitative and qualitative. The quantitative phase reports on (1) the content validity (Aiken's V) and inter-rater reliability (Cohen's Kappa) of the algebra and geometry questions, and (2) the descriptive statistics of students' numeracy scores and their categorization into high, medium, and low numeracy groups. The qualitative phase focuses on (1) students' written responses to algebra and geometry problems presented in personal contexts, analyzed based on the three numeracy indicators, and (2) interview findings that offer deeper insights into how students with different numeracy abilities approached and reasoned through contextualized problem-solving situations. To provide a more comprehensive understanding of students' numeracy skills, the qualitative findings were triangulated with data from semi-structured interviews. The excerpts presented below serve to complement and validate the written test responses. Each excerpt is followed by the researcher's interpretation to provide a complete understanding of students' thought processes in solving problems involving personal contexts.

The results of the content validity analysis using Aiken's V, as displayed in the SPSS output and shown in Figure 2, indicate that the four indicators assessed in this study, including the algebra questions, have a high level of validity, as verified by two expert validators. Each indicator for algebra question namely relevance to numeracy concepts, understanding of tables/data, real-life relevance, and clarity and simplicity of the questions received an Aiken's V score of 0.83. This value indicates a strong agreement among expert raters regarding the appropriateness and relevance of each item. Based on Aiken's criteria, a value of 0.80 or above is considered to demonstrate a high degree of content validity.

Descriptive Statistics

	N	Minimum	Maximum	Mean
AikenV	4	.83	.83	.8333
Valid N (listwise)	4			

Case Processing Summary[a]

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
Indicator * AikenV	4	100.0%	0	0.0%	4	100.0%

a. Limited to first 100 cases.

Case Summaries[a]

				Indicator
AikenV	.83	1		Relevance to Numeracy Concepts
		2		Understanding of Tables/Data
		3		Relevance to Real-Life Situations
		4		Clarity&Siplicity of the problem
		Total	N	4
	Total	N		4

a. Limited to first 100 cases.

Figure 2. Aiken's V output for the content validity of algebra

Furthermore, the Aiken's V values for the indicators in the geometry question were grouped into two categories; four indicators namely relevance to geometry concepts, application of price based on size, alignment with real-life context, and clarity and simplicity of the question achieved a coefficient of 0.83, indicating high content validity, as can be seen in Figure 3. Meanwhile, the indicator diversity and variability of questions achieved the highest value of 1.00, which denotes excellent content validity. Therefore, the obtained results suggest that all the indicators used in this instrument are valid and suitable for measuring the intended constructs. The consistency in Aiken's V values across all indicators also reflects that the items are well-constructed.

Descriptive Statistics

	N	Minimum	Maximum	Mean
AikenV	5	.83	1.00	.8667
Valid N (listwise)	5			

Case Processing Summary[a]

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
Indicator * AikenV	5	100.0%	0	0.0%	5	100.0%

a. Limited to first 100 cases.

Case Summaries[a]

				Indicator
AikenV	.83	1		Relevance to Geometry Concepts
		2		Application of Price Based on Size
		3		Alignment with Real-Life Context
		4		Clarity and Simplicity of the Question
		Total	N	4
	1.00	1		Diversity and Variability of Questions
		Total	N	1
	Total	N		5

a. Limited to first 100 cases.

Figure 3. Aiken's V output for the content validity of geometry

The results of the Cohen's Kappa analysis revealed perfect agreement between rater 1 and rater 2 in assessing the students' performance on the geometry and algebra questions, as can be seen in Figure 4. With a Kappa value of 1.000, this indicated that both raters provided identical scores for all students, reflecting complete consistency in their evaluations. The asymptotic standard error of 0.000 further emphasized the precision of this result, indicating that the Kappa statistic was highly accurate. Additionally, the p-value of 0.000 showed that the observed agreement was statistically significant, meaning the consistency between the raters was not due to random chance. The analysis demonstrated that the algebra and geometry problems were reliable, given the perfect agreement between the two raters.

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Total Score (Rater 1) * Total Score (Rater 2)	17	100.0%	0	0.0%	17	100.0%

Total Score (Rater 1) * Total Score (Rater 2) Crosstabulation

Count

		Total Score (Rater 2)					Total
		3	4	5	6	7	
Total Score (Rater 1)	3	3	0	0	0	0	3
	4	0	3	0	0	0	3
	5	0	0	5	0	0	5
	6	0	0	0	2	0	2
	7	0	0	0	0	4	4
Total		3	3	5	2	4	17

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Measure of Agreement	Kappa	1.000	.000	7.978	.000
N of Valid Cases		17			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Figure 4. Cohen's Kappa analysis output

The results of the Aiken's V analysis indicated that the content validity of the interview guide was high, as can be seen in Figure 5. The mean Aiken's V score of 0.8810 suggested that, on average, the questions in the interview guide were considered highly relevant by the raters. The minimum value of 0.83 and the maximum value of 1.00 demonstrated strong agreement among raters regarding the relevance of the questions, with some questions achieving perfect validity (1.00). Specifically, indicators such as relevance to the research objectives, clarity of the questions, accuracy of the language, suitability with the measured indicators, and ability to encourage discussion all scored above 0.83, showing that these aspects were highly relevant to the research objectives. Additionally, the indicators related to the completeness of the questions and relevance to the numeracy indicators scored 1.00, confirming perfect agreement between the raters. Overall, these results suggested that the interview guide was well-constructed and had good content validity, meaning that it effectively measured the intended constructs and aligned with the research objectives.

Descriptive Statistics

	N	Minimum	Maximum	Mean
AikenV	7	.83	1.00	.8810
Valid N (listwise)	7			

Case Processing Summary[a]

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
Indicator * AikenV	7	100.0%	0	0.0%	7	100.0%

a. Limited to first 100 cases.

Case Summaries[a]

				Indicator
AikenV	.83	1		Relevance to the Research Objectives
		2		Clarity of the Questions
		3		Accuracy of the Language
		4		Suitability with the Measured Indicators
		5		Ability to Encourage Discussion
		Total	N	5
	1.00	1		Completenes s of the Questions
		2		Relevance to the Numeracy Indicators
		Total	N	2
	Total	N		7

a. Limited to first 100 cases.

Figure 5. Aiken's V output for the content validity of interview guide

Furthermore, the results of the MCA numeracy test of 17 students are shown in Table 4.

Table 4. Students' numeracy MCA test results

Nama	Geometry Score	Algebra Score	Total Score
Student_1	2	3	5
Student_2	4	3	7
Student_3	3	2	5
Student_4	3	3	6
Student_5	2	1	3
Student_6	2	2	4
Student_7	1	2	3
Student_8	4	3	7
Student_9	3	4	7
Student_10	3	2	5
Student_11	1	3	4
Student_12	4	3	7
Student_13	4	1	5
Student_14	2	3	5
Student_15	2	2	4
Student_16	2	1	3
Student_17	2	4	6

Figure 6. showed the score of each question content and the calculation of the mean and standard deviation.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Geometry Score	17	1.0	4.0	2.588	1.0037
Algebra Score	17	1.0	4.0	2.471	.9432
Total	17	3.00	7.00	5.0588	1.43486
Valid N (listwise)	17				

Figure 6. Score of each question content and the calculation of the mean and standard deviation

From the results of the previous calculations, Table 5 below presented the grouping of student numeracy categories.

Table 5. Student numeracy categories

Category	Grouping Formula	Number of Students
High	$X \geq \bar{X} + SD: X \geq 6.49$	4
Medium	$(\bar{X} - SD) \leq X < (\bar{X} + SD): 3.62 \leq X < 6.49$	10
Low	$X < (\bar{X} - S): X < 3.62$	3

To further analyze the students' numeracy abilities, one student was selected from each category (high, medium, and low) for a detailed examination of their test responses and interview results. The results of the numeracy test are presented in Table 6, which indicates subjects with high, medium, and low numeracy abilities.

Table 6. Subject Code

No	Students Initials	Category	Subject Code
1	AY	High	HN
2	RNP	Medium	MN
3	RS	Low	LN

As shown in Figure 7, HN demonstrated a strong command over algebraic concepts by correctly applying basic mathematical operations and solving the given algebraic expressions. HN used mathematical symbols and numbers correctly in solving the problem and arrived at the correct answer. HN analyzed the problem logically, identifying the necessary steps to solve the equation. HN identified information from the ticket price table by mentioning the ticket prices based on categories (local/domestic, international, children/adult). In the response, HN answered and verified several statements in the question, demonstrating the ability to make decisions after calculating and comparing the total cost. HN used his understanding of algebra to manipulate the equation and ensure that the solution was consistent with the given conditions.

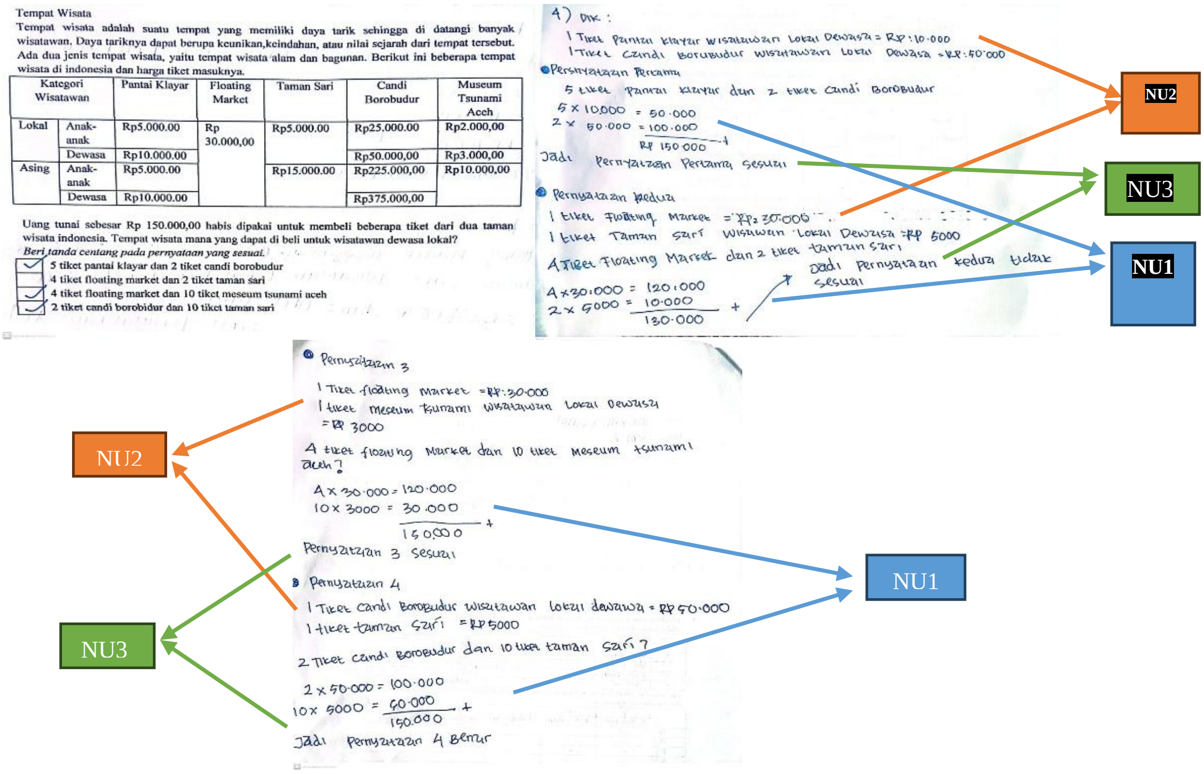

Figure 7. Student HN's Algebra Response

In the interview, HN demonstrated their ability to analyze information presented in different formats, fulfilling the NU2 indicator. HN identified key details from the ticket price table, noting the differences between local and foreign prices, as well as the distinct prices for children and adults. HN also identified patterns in the data, such as recognizing higher or lower prices based on the ticket category, and explained the steps taken to solve the problem, which involved matching the correct category with the corresponding price and calculating based on the number of tickets. In terms of the NU1 indicator, HN used basic mathematical operations, multiplication to calculate the price per ticket and addition to determine the total cost. HN described how they checked the table for ticket prices and performed calculations accordingly, showing their understanding of basic arithmetic in real-life scenarios. Regarding the NU3 indicator, HN was able to interpret the results of their analysis by identifying the cheapest and most expensive tickets, and by determining which tickets fit within their budget. HN also took steps to ensure the accuracy of their calculations by double-checking the prices and re-verifying the total cost. Furthermore, HN connected the mathematical problem-solving process to real-life situations, explaining how this knowledge would help their family plan a vacation by understanding ticket prices and budgeting accordingly. This demonstrated HN's ability to make decisions based on numerical analysis and apply these skills in everyday life. Below are the results of the interview excerpt with the subject HN.

R	:	*What key information stands out to you when you look at the data presented in this table*	
HN	:	*The prices for different categories of tickets stand out to me, like the difference between local and foreign prices, and also the different prices for kids and adults*	*NU2*
R	:	*How do you identify patterns or trends from the data presented?*	
HN	:	*I look for categories that have the same price, and I also notice if the prices are higher or lower based on the type of ticket (local or foreign)*	*NU2*
R	:	*What steps do you take to solve problems based on this data?*	
HN	:	*I match the correct category of the ticket with the price and calculate based on the number of tickets I need.*	*NU2*
R	:	*How do you use mathematical symbols and operations in solving this problem?*	
HN	:	*I use multiplication for the ticket prices and addition for the total costs, applying the prices based on the categories given in the table.*	*NU1*
R	:	*Could you explain the steps you followed to solve this calculation?*	
HN	:	*First, I check the table for ticket prices, then I multiply the number of tickets with the respective price for each category like local, foreign, or children and adults.*	*NU1*
R	:	*What is the first step you take when working on this type of problem?*	
HN	:	*I look at the table to find the prices and categories first, then I start multiplying them according to the number of tickets.*	*NU1*
R	:	*After analyzing the data, how do you interpret the results?*	
HN	:	*After calculating, I know which tickets are the cheapest and which are the most expensive. I figured out which tickets fit within the budget*	*NU3*
R	:	*When making decisions, what steps do you take to ensure that the answers are valid?*	
HN	:	*I double-check the prices from the table to make sure I'm using the correct values and the right ticket categories, then I recheck my total calculations*	*NU3*
R	:	*Are you sure with your answer?*	
HN	:	*Sure, sis.*	
R	:	*Can you explain how this relates to real-life situations or how you might use this knowledge in everyday life?*	

HN	:	*Oh, this is actually useful in real life! Like when my family plans a vacation, we need to check ticket prices for different places. Sometimes there are different prices for locals and tourists, or for kids and adults. By understanding how to calculate the total cost, we can budget better and decide which places we can afford to visit. It helps us make smart choices with our money and plan our trip better!"*	*NU3*

As shown in Figure 8, HN displayed an excellent understanding of geometry, calculating the areas of ceramics accurately using the correct geometric formulas. HN used two tables; the table of ceramic shapes and sizes and the table of ceramic prices based on area. HN matched the area calculation results with the price categories per cm². There was evidence that HN read and interpreted information from the visual representation (the image of the ceramic) and linked it with the quantitative data from the tables. HN used logical reasoning to select the correct formula and apply it to the measurements given in the problem. HN successfully interpreted the calculations and concluded the correct results for the area of each ceramic. HN used the understanding of geometry to predict the appropriate prices based on the areas calculated. After calculating all the areas and comparing them with the price table, HN concluded the specific shape and price pairings. This showed that HN used the results of the analysis to make the final decision in line with the context of the problem. This demonstrated HN's ability to use mathematical results in decision-making, meeting NU3 indicator. HN's performance in geometry demonstrated a high level of competency in understanding geometric concepts and applying them accurately. The ability to analyze and interpret results effectively, coupled with the logical approach to solving the problem, allowed them to meet NU1, NU2, and NU3 indicators.

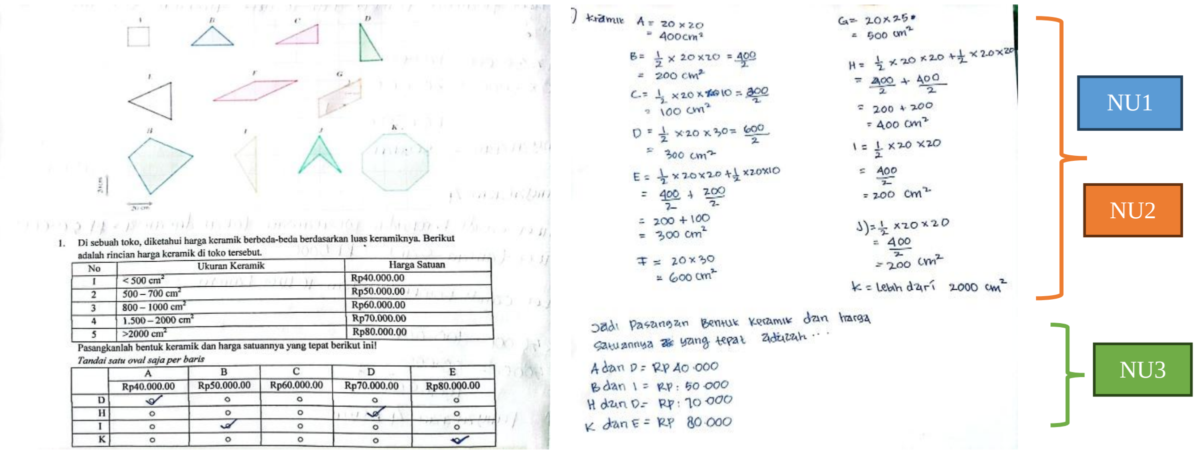

Figure 8. Student HN's Geometry Response

In the interview, for NU1 indicator, HN showed competence in performing basic mathematical operations such as multiplication and division. They correctly applied the area formula, using the dimensions given in the problem (20 cm x 20 cm) to calculate the areas of the ceramic shapes. HN effectively utilized the appropriate mathematical symbols and operations to solve the problem. For NU2 indicator, HN demonstrated an ability to extract key information from the table, such as the unit price for each ceramic shape and the corresponding dimensions. They identified patterns in the data, such as the relationship between the shape's price and size, and used these patterns to match the shapes with the correct prices. HN also showed an understanding of how to analyze the data to match the correct pairs. In terms of NU3 indicator, HN concluded the correct pairs of ceramic shapes and prices, after performing calculations. HN ensured the accuracy of their work by double-checking both the dimensions and their calculations. Moreover, HN linked the task to a real-life situation, explaining how knowledge of calculating areas and matching prices would be useful when purchasing floor tiles for a house. This not only demonstrated their ability to make an informed decision but also their ability to apply the learned knowledge in practical, everyday contexts. The following is an excerpt from an interview with subject HN.

R :	*What key information stands out to you when you look at the data presented in this table and graph?*	
HN :	*The key information is the unit price of the ceramic and how it corresponds to the different shapes, like square or triangle*	*NU2*
R :	*How do you identify patterns or trends from the data presented?*	
HN :	*I look for the ceramic shapes that match the prices and sizes, then compare the areas to find the correct match*	*NU2*
R :	*What steps do you take to solve problems based on this data?*	
HN :	*I first calculate the area for each shape using the given dimensions, and then I match them with the correct price listed in the table*	*NU2*
R :	*How do you use mathematical symbols and operations in solving this problem?*	
HN :	*I used multiplication and division to calculate the area of the ceramic shape and then matched the area with the price based on the table*	*NU1*
R :	*Could you explain the steps you followed to solve this calculation?*	
HN :	*First, I looked at the length of the side stated in the question, which was 20 cm x 20 cm. After that, I determined the types and shapes of ceramics that existed, namely squares, triangles and other shapes. Then, I started calculating the area of the ceramic shape.*	*NU1*
R :	*What is the first step you take when working on this type of problem?*	
HN :	*The first thing I do is check the dimensions of the ceramic shape in the question, and then I calculate the area*	
R :	*After completing question number 2, what conclusion do you get from the question?*	
HN :	*The correct pairs of ceramic shapes and their unit prices are A and D, B and I, H and D, K and E.*	*NU3*
R :	*When making decisions, what steps do you take to ensure that the answers are valid?*	
HN :	*I double-check the dimensions of the shapes and make sure the calculations for the area are correct before matching the prices*	*NU3*
R :	*Can you explain how this is useful in real life or how you might use this knowledge daily?*	
HN :	*Well, knowing how to calculate areas and match them with prices is really useful. For example, if we want to buy floor tiles for our home, we need to know how much area each tile covers and how much they cost. This helps our family choose tiles that fit our budget and room size. It's like planning a project where every number matters so we don't overspend and everything fits perfectly*	*NU3*

Furthermore, MN was a subject who has moderate numeracy abilities. As shown in Figure 9, MN was able to identify the key information in the problem, such as the ticket prices for each attraction and the number of tickets to be purchased. MN correctly used mathematical symbols (multiplication and addition signs) and wrote the numbers accurately. MN understood the basic concept of multiplication (for calculating the total price of tickets) and addition (for calculating the final cost). MN managed the calculations systematically by evaluating each option separately. The NU1 indicator was fulfilled, MN was able to perform basic mathematical operations. However, although data was used, not all information was analyzed thoroughly. For example, MN only wrote down a few calculations without providing a complete explanation of the process for determining what was correct or incorrect. Therefore, the NU2 indicator was partially fulfilled. In the NU3 indicator, at the top of the paper, MN wrote, "*The correct statements are statements 1, 3, and 5*." However, the question only provided four statements, which suggests a lack of attention to detail or an error in drawing conclusions. There was no explanation provided for why those statements were chosen, nor was there any clarification on how the calculations were used as the basis for the practical decision-making process. As a result, NU3 was not fully met. This indicates that MN still struggles with the NU3 indicator, specifically in being unable to draw accurate and comprehensive conclusions from the results of the calculations.

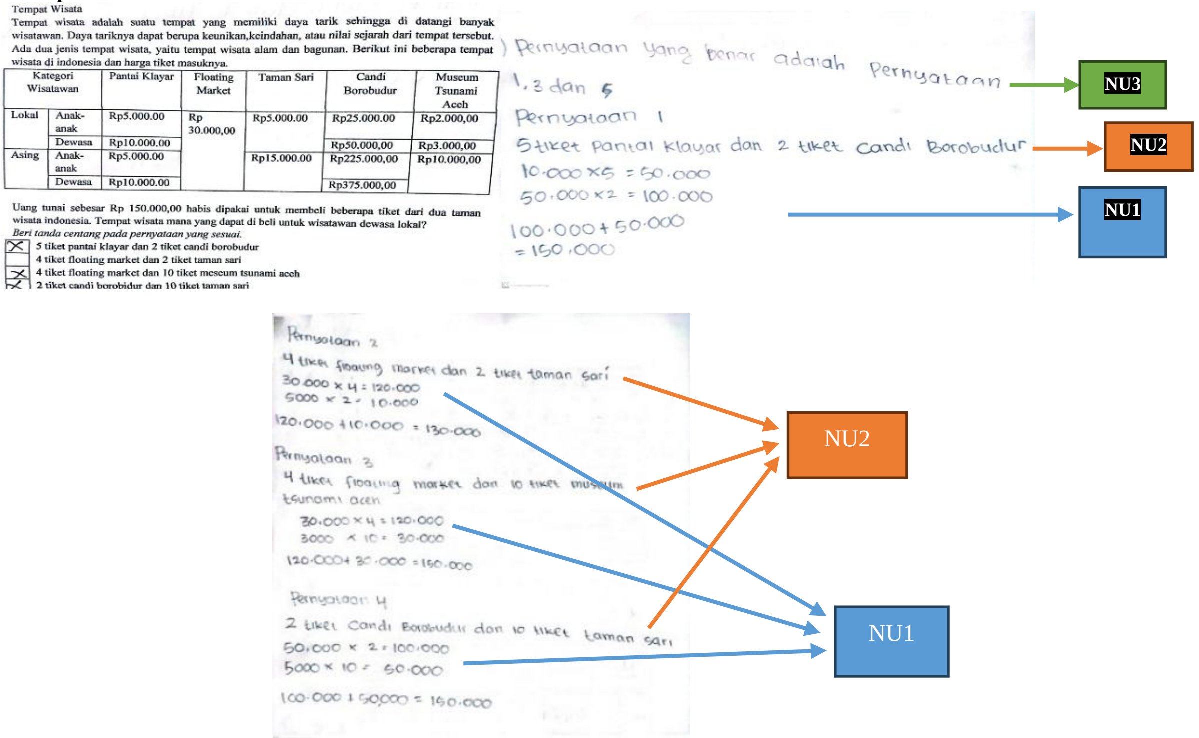

Figure 9. Student MN's Algebra Response

During the interview, MN understood that the problem provided a table with ticket price information. MN explained that the first step was to read the question thoroughly and then begin calculating by ensuring that each statement matched the given ticket price (Rp150,000). This shows MN had a systematic approach to problem-solving and calculation. MN mentioned that after completing the question, the conclusion was that statements 1, 3, and 4 was correct. However, even though MN reached a conclusion, MN did not write it down on answer sheet. MN admitted that hesitation and forgetfulness led to MN not including the conclusion in MN's written response. This indicated a lack of confidence or difficulties in organizing MN's thoughts, which resulted in the final documentation being incomplete. Furthermore, MN was not yet sure how to relate the results of the calculations to practical applications in everyday life, showing doubt and uncertainty in making decisions based on the calculations. The following is an excerpt from an interview with subject MN.

R	:	*What key information stands out to you when you look at the data presented in this table and graph?*	
MN	:	*What stands out to me is the ticket price, especially the differences between local and foreign prices, and also the prices for children and adults*	*NU2*
R	:	*How do you identify patterns or trends from the data presented?*	
MN	:	*I look at the prices listed for each category, and I match them with the ticket options to see which prices match*	*NU2*
R	:	*What steps do you take to solve problems based on this data?*	
MN	:	*I calculate the total price for each ticket and then compare them with the prices in the table to make sure they match*	*NU2*

R	:	*How do you use mathematical symbols and operations in solving this problem?*	
MN	:	*I used multiplication to calculate the total price of the tickets, and then I added them up to find the total cost*	NU1
R	:	*Could you explain the steps you followed to solve this calculation?*	
MN	:	*I started calculating, of course the value of each statement must be in accordance with the price given, which is Rp. 150,000.*	NU1
R	:	*After completing question number 1, what conclusion do you get from the question?*	
MN	:	*Hmm, it looks like statements 1,3, and 4 are appropriate*	NU3
R	:	*If so, why don't you write the conclusion on the answer sheet?*	
MN	:	*I was doubtful and forgot too, sis*	
R	:	*Can you explain how this might be useful in everyday life?*	
MN	:	*I guess knowing how to do this might help when you decide if a ticket or a price is fair. But, honestly, I'm not really sure how I would use it every day*	

As shown in Figure 10, MN was able to identify and apply appropriate geometric formulas to calculate the area of various ceramic shapes. For NU1 indicator, this demonstrated a solid understanding of basic operations and formula selection. MN attempted to calculate the area of each shape, and most formulas were correctly used, such as calculating the area of squares and triangles. However, the accuracy of the calculations was inconsistent. For NU2 indicator, while some results were correct, others were either incomplete or lacked precision, especially in multi-step calculations. Furthermore, MN did not provide a clear conclusion or synthesis of the results. The final answer lacked a summary that matched the calculated areas to the correct price categories from the given table. In the NU3 indicator, this indicated that MN was not confident in interpreting the results or applying them to practical decision-making tasks. Overall, MN showed a procedural grasp of geometry but struggled to organize and integrate the information into a coherent and meaningful conclusion.

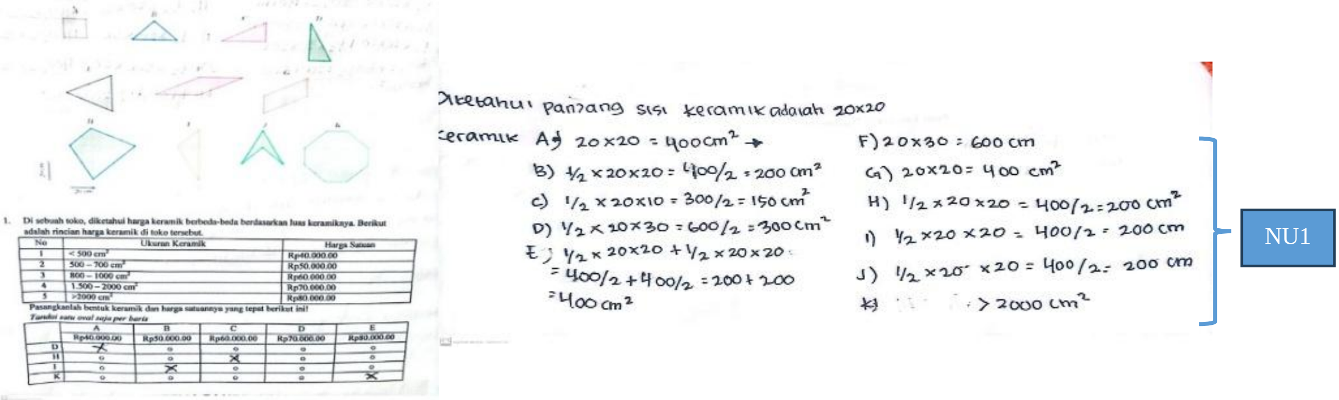

Figure 10. Student MN's Geometry Response

In the interview, MN faced some challenges in applying numeracy skills effectively, particularly in analyzing and solving the task. For NU1 indicator, MN showed basic understanding of the mathematical operations required. They recognized the shapes of the ceramics and attempted to calculate the area using the dimensions provided. However, MN's explanation of the steps was somewhat vague, as MN mentioned looking at the shapes and using numbers from the question without clearly outlining the calculation process. This suggests that while MN understood the basic concept, MN struggled to articulate the specific mathematical operations they used. For NU2 indicator, MN identified some of the key information in the table, such as the prices and sizes. However, MN expressed confusion due to the large number of different shapes and prices, indicating that MN had difficulty organizing and processing the data effectively. MN also mentioned trying to match prices with sizes but did not notice a clear pattern in the data. This partial engagement with the data suggests that MN was able to attempt problem-solving but struggled with deeper analysis or recognizing trends in the information presented. In terms of NU3 indicator, MN's response showed that MN was still uncertain about how to interpret the results. MN was able to state some pairs of ceramic shapes and their corresponding prices but admitted to feeling confused by the large number of tiles to calculate. MN did not provide a clear rationale for why those pairs were selected, suggesting that they lacked confidence in interpreting the data and making final decisions. When asked about the real-life application, MN recognized the usefulness of the skill in purchasing tiles for a room but did not elaborate on how this process could be applied more broadly in daily life. The following is an excerpt from an interview with subject MN.

R	:	*What key information stands out to you when you look at the data presented in this table and graph?*	
MN	:	*I look at the numbers, like the prices and sizes, but it's a bit confusing because there are so many different shapes and prices*	*NU2*
R	:	*How do you identify patterns or trends from the data presented?*	
MN	:	*I guess I look for prices that match the sizes, but I didn't really notice any clear pattern*	*NU2*
R	:	*What steps do you take to solve problems based on this data?*	
MN	:	*I just tried to calculate the area and then looked at the prices to see which one fits*	*NU2*
R	:	*How do you use mathematical symbols and operations in solving this problem?*	
MN	:	*recognize the shape of the ceramic given in the question, after that I calculated the side area of the ceramic, after finding the formula for calculating the area of a triangle I immediately entered the side value, sis*	*NU1*
R	:	*Could you explain the steps you followed to solve this calculation?*	
MN	:	*I looked at the shape, then tried to figure out how to calculate the area, then I just used the numbers from the question and did the math.*	*NU1*
R	:	*What is the first step you take when working on this type of problem?*	
MN	:	*I check the shape of the tile, then look at the numbers and try to do the math to get the area."*	*NU1*
R	:	*After analyzing the data, how do you interpret the results?*	
MN	:	*I am a bit confused, because there are too many tiles to calculate the area. The tile pairs are A and D, H and C, I and B and K and E.*	*NU3*
R	:	*Can you explain how this process might be useful in real life or in everyday situations?*	
MN	:	*I think knowing how to figure out the area could help when you need to buy the right amount of tiles for a room or something like that.*	*NU 3*

In addition, LN was a subject with low numeracy skills. As shown in Figure 11, LN demonstrated limited numeracy ability. For NU1 indicator, LN attempted basic arithmetic operations such as multiplication, but the calculations were often incomplete or lacked accuracy. For NU2 indicator, LN showed difficulty understanding and analyzing the structure of the table, and did not refer explicitly to categories such as ticket types or visitor types. Most responses consisted of isolated calculations without interpreting what they meant or how they related to the context of spending Rp150,000 on local adult tickets. In the NU3 indicator, LN did not provide any conclusion or indication of which statements were correct, showing an inability to use results for decision-making. This response reflected a lack of strategic approach and minimal engagement with the contextual problem, indicating the need for foundational support in both mathematical operations and comprehension of contextual tasks.

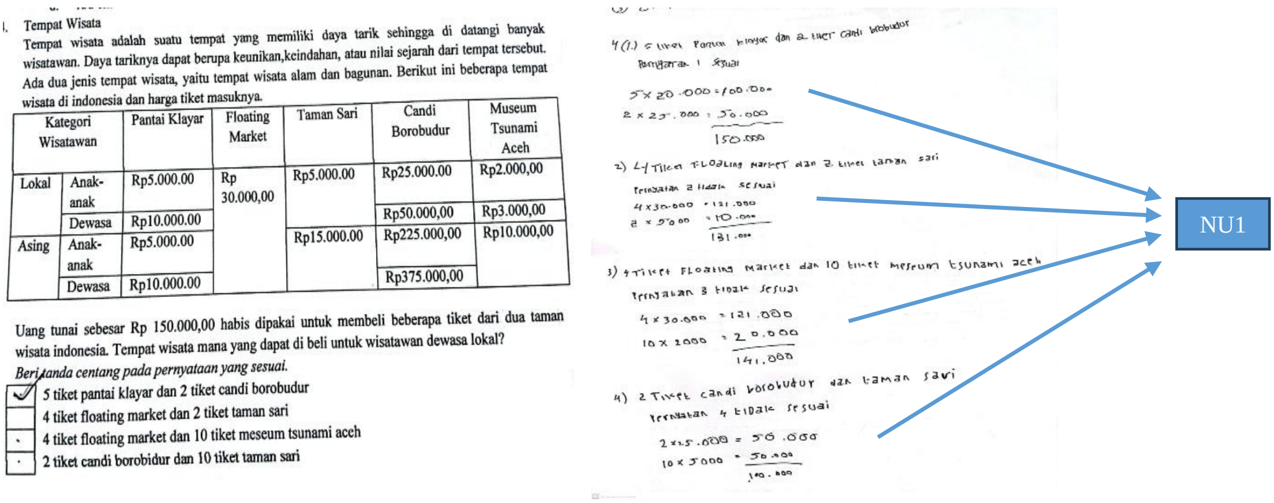

Figure 11. Student LN's Algebra Response

During interview, LN struggled significantly with the problem-solving task related to the ticket prices. For NU1 indicator, LN admitted to having difficulty understanding the problem, stating that they tried to match the ticket prices without fully grasping the mathematical operations involved. LN mentioned they were asked to match prices but struggled with multiplication, which affected their ability to apply the correct mathematical symbols and operations. This suggests that LN’s numeracy skills were limited, especially in applying arithmetic operations correctly. For NU2 indicator, LN showed minimal engagement with the data presented in the table. When asked about identifying patterns or trends, LN expressed uncertainty, stating that they were unsure how to find patterns and simply tried to match the prices. This indicates that LN faced challenges in analyzing the information effectively, as they did not recognize any significant relationships between the data or how to use it to solve the problem accurately. In terms of NU3 indicator, LN was unable to make a clear interpretation of the results. When asked to explain how they arrived at the solution, LN admitted uncertainty, indicating a lack of confidence in their conclusions. They also expressed doubt about whether they got the right answer, further suggesting that LN had difficulty making informed decisions based on their calculations. When asked about the real-life application of the task, LN could not connect the problem-solving process to everyday situations, which further indicated a disconnect between the task and its practical use. The following is an excerpt from an interview with the subject LN.

R	:	*What key information stands out to you when you look at the data presented in this table or graph?*	
LN	:	*I don’t really understand the table much, I just try to see the ticket prices and match them*	*NU2*
R	:	*How do you identify patterns or trends from the data presented?*	
LN	:	*I don’t really know how to find a pattern, I just try to see which price matches*	*NU2*
R	:	*What steps do you take to solve problems based on this data?*	
LN	:	*I look at the prices, but I’m not sure if I’m matching them right*	*NU2*
R	:	*How do you use mathematical symbols and operations in solving this problem?*	
LN	:	*I was asked to match the ticket prices, but I’m not really good at multiplying, so I just tried my best*	*NU1*
R	:	*Could you explain the steps you followed to solve this calculation?*	
LN	:	*I tried multiplying the numbers, but they were too big for me, so I just did what I could.*	*NU1*

R	:	*What is the first step you take when working on this type of problem?*	
LN	:	*I look at the prices and just try to match them, but I'm not sure if I'm doing it right*	*NU1*
R	:	*After analyzing the data, how do you interpret the results?*	
LN	:	*I don't really know, sis. I'm not sure if I got the right answer.*	*NU3*
R	:	*Can you explain how this process might be useful in real life or in everyday situations?*	
LN	:	*I don't know sis*	

Moreover, as shown in Figure 12, LN struggled with geometry, failing to identify the correct geometric formulas to calculate areas. For NU1 indicator, LN wrote the side length of the ceramic as 20 cm × 20 cm, but only for one shape, and did not proceed with area calculations for the others. There was no evidence of applying geometric formulas for triangles or irregular shapes. For NU2 indicator, instead of computing areas, LN attempted to match ceramic shapes to prices using a table filled with checkmarks, with no explanation of how the matches were made or what criteria were used. In terms of NU3 indicator, the response lacked any form of interpretation or conclusion, and LN did not attempt to relate the calculated areas to pricing, demonstrating a complete absence of reasoning or decision-making based on analysis. This response indicated a superficial approach, relying on guessing rather than logical reasoning or mathematical understanding, and reflected a significant need for support in both basic operations and contextual problem-solving.

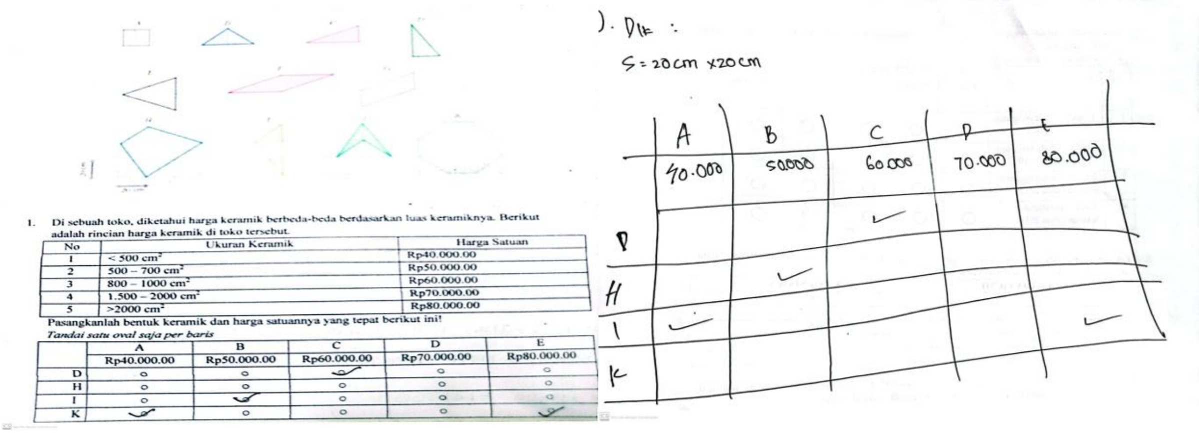

Figure 12. Student LN's Geometry Response

In the interview, LN faced significant difficulty with the geometry problem and struggled to apply the necessary numeracy skills to solve it. For NU1 indicator, LN admitted that LN could not perform the required mathematical operations. LN expressed frustration, saying, "*I can't really do the math, sis. I just guess the answer*." This indicates that LN struggled with basic arithmetic operations and was unable to apply them effectively to solve the problem. In terms of NU2 indicator, LN was unable to analyze the data provided in the table or graph effectively. When asked about identifying patterns or trends, LN stated, "*I don't really understand how to look for patterns. I just guess the price that seems right*." This suggests that LN was not able to make meaningful connections between the shapes, prices, and how they were supposed to match. LN seemed to lack the skills to interpret and analyze the information, which made it difficult for them to approach the problem in a structured way. For NU3 indicator, LN struggled to draw any conclusions or interpret the results of their analysis. LN admitted, "*I don't know what the right answer is, sis. I couldn't figure it out*," which showed that LN was unable to make informed decisions based on the data provided. LN also expressed uncertainty about the real-life relevance of the task, stating, "*I don't know sis*," when asked how the process could be applied in everyday situations. The following is an excerpt from an interview with the subject LN.

R	:	*What key information stands out to you when you look at the data presented in this table or graph?*	
LN	:	*I only see the prices and the shapes, but I don't really know what to do with that information*	*NU2*
R	:	*How do you identify patterns or trends from the data presented?*	
LN	:	*I don't really understand how to look for patterns. I just guess the price that seems right*	*NU2*
R	:	*What steps do you take to solve problems based on this data?*	
LN	:	*I look at the shapes and prices, but I don't really know how to match them. I just try to guess*	*NU2*
R	:	*How do you use mathematical symbols and operations in solving this problem?*	
LN	:	*I can't really do the math, sis. I just guess the answer*	*NU1*
R	:	*Could you explain the steps you followed to solve this calculation?*	
LN	:	*I can't count it, sis, I can only guess.*	*NU1*
R	:	*Are you having trouble solving this problem?*	
LN	:	*Yes sis, I don't know the formula to find the area of all the ceramics.*	
R		*After analyzing the data, how do you interpret the results?*	
LN		*I don't know what the right answer is, sis. I couldn't figure it out*	*NU3*
R	:	*Can you explain how this process might be useful in real life or in everyday situations?*	
LN	:	*I don't know sis*	

Table 7 summarizes the performance of each student (HN, MN, and LN) across the three numeracy indicators (NU1, NU2, and NU3).

Table 7. Performance of Students across Numeracy Indicators

Numeracy Indicators	HN Subject	MN Subject	LN Subject
NU1: Able to use various types of numbers or symbols related to basic mathematics in solving daily life problems.	Demonstrated a strong command over algebraic and geometric concepts, applying symbols and numbers correctly in real-world problems.	Competent with basic calculations but struggled with more complex problems. Demonstrated understanding of basic operations.	Faced significant difficulty with basic calculations, relying on guessing. Struggled to use symbols and operations effectively.
NU2: Able to analyze information displayed in various forms (graphs, tables, charts, diagrams, etc.)	Was highly effective at analyzing data from tables, graphs, and diagrams, using them logically and systematically.	Could analyze basic data methodically but struggled with complex information or multi-variable analysis.	Struggled with processing and interpreting information from tables or graphs, relying mostly on guesswork.
NU3: Interpret the results of the analysis to predict and make decisions.	Confidently interpreted results and connected mathematical reasoning to real-life decision-making, providing well-supported conclusions.	Was able to reach correct conclusions but had difficulty explaining practical applications of the results.	Was unable to make correct conclusions or apply calculations to real-life situations. Lacked confidence in decision-making based on mathematical analysis.

HN demonstrated strong numeracy skills, efficiently using symbols and numbers, accurately analyzing information, interpret the results and applying results to real-life situations. MN showed moderate skills; MN can perform calculations and analyze data, but struggles with complexity and translating results into practical decisions. In contrast, LN faced significant challenges in numeracy; basic calculation and analysis are problematic, and LN is unable to connect math concepts to everyday contexts.

In the context of the Minimum Competency Assessment (MCA) which emphasizes real-life and personal contexts in the problems, these numeracy indicators align well with how personal context could influence student performance. HN's strong performance is a reflection of how well students can relate abstract mathematical concepts to real-world applications. Research by (Abylkassymova et al., 2024; Hidayah et al., 2021; Tsaqifah et al., 2024) supports this, highlighting that contextualized problems lead to deeper engagement and better application of mathematical theory in everyday situations. In HN's case, HN abilities to analyze and interpret mathematical information accurately shows the value of incorporating personal contexts in assessments. By solving problems related to real-life scenarios, such as ceramic area calculations, HN was able to make decisions that connected directly to personal contexts, demonstrating the practical utility of numeracy in daily life. Incorporating personal context into mathematical problems, such as those relevant to students' own lives or future careers, can make learning more meaningful and enjoyable. This approach has been shown to improve students' ability to connect mathematical concepts with their personal experiences, thereby enhancing their numeracy literacy skills (Satiti et al., 2021). Integrating personal and socio-cultural contexts into numeracy assessments helps students relate mathematical ideas to their own life experiences and cultural perspectives. This approach can enhance their problem-solving abilities and foster a more favorable attitude towards mathematics (Usman & Rahman, 2024). The use of context-based problems in the MCA has been shown to improve students' numeracy skills. By practicing with problems that reflect real-world situations, students become more adept at applying mathematical concepts in practical contexts (Hwang & Utami, 2024).

On the other hand, MN's struggles illustrate how personal context may not always lead to better outcomes if the students have gaps in their ability to apply fundamental concepts. While personal context can engage students, MN's challenges suggest that more emphasis is needed on developing foundational skills for critical thinking and decision-making (Adelia et al., 2024). This aligns with findings by (Lubis & Permatasari, 2023), who suggest that students must first master the basics of algebra and geometry before they can fully benefit from contextualized learning. The ability to apply geometric reasoning to real-life contexts, such as calculating areas and volumes, requires a strong understanding of spatial concepts and the correct application of formulas. Algebraic proficiency in solving equations and analyzing relationships between variables also plays a crucial role in MCA performance (Adelia et al., 2024). While the findings from (Lubis & Permatasari, 2023) highlight that moderate numeracy skills are crucial, our study suggests that motivational factors, such as self-confidence or familiarity with the task, might further influence students' success. MN's inability to fully grasp the real-world relevance of the problem suggests that the gap in practical application could stem from a lack of confidence in their mathematical abilities or insufficient experience with tasks that require critical decision-making (Tsaqifah et al., 2024). In this context, critical thinking is integral to numeracy, as it involves evaluating information, making informed decisions, and solving problems (Bjälkebring & Peters, 2021; Jain & Rogers, 2019; Nahdi et al., 2020). This is particularly relevant in the context of MCA, where critical thinking skills are assessed alongside numeracy abilities. While the emphasis on foundational skills is crucial, it is also important to consider the role of personal context in engaging students. Personal context can make learning more relevant and meaningful, potentially increasing motivation and interest. However, without a strong foundation in critical thinking and numeracy, students may struggle to apply their knowledge effectively in real-world situations. Therefore, a balanced approach that incorporates both foundational skills and personal context may be most effective in developing well-rounded, critical thinkers (Duma et al., 2024; Hamdiyanti et al., 2024).

LN's low performance further demonstrates the challenge of personal contexts when students lack basic numeracy skills. Even with problems rooted in familiar, real-life scenarios, the inability to apply and interpret mathematical concepts limits the effectiveness of such assessments for students with low numeracy abilities. As noted by (Susanto et al., 2023), students with lower numeracy abilities often struggle to connect abstract mathematical skills with practical situations. Difficulties in solving verbal problems and understanding mathematical principles are common among students with lower numeracy abilities, highlighting the need for targeted interventions to improve these skills (Halawati & Hidayati, 2023). The subject also demonstrated weaknesses in solving geometry problems, which was consistent with (Dintarini et al., 2022), which stated that students faced difficulties in visualizing geometric shapes when solving MCA problems. The lack of engagement in interpreting the results suggests that LN students require more structured learning environments that focus on building foundational numeracy skills before engaging in context-based problems (K. Gravemeijer, 2016).

One key aspect that emerged from the study is the role of personal context in student engagement and performance. The MCA framework, which incorporates personal contexts into mathematics problems, was effective in making tasks more relatable for high-performing students. As HN demonstrated, personal contexts can enhance the connection between abstract mathematical concepts and real-life applications, leading to better decision-making skills. However, for MN and LN, the personal context was not sufficient to bridge the gap in their understanding. These findings highlight the need for scaffolded learning that gradually increases in complexity and explicitly connects mathematical procedures with real-life scenarios. This approach is consistent with Vygotsky's Zone of Proximal Development, which suggests that effective learning occurs when tasks are within the student's developmental range, supported by appropriate guidance (Vygotsky, 1978). The lack of critical application observed in MN and LN can be attributed to cognitive and instructional factors. According to Vygotsky's Zone of Proximal Development, students are most likely to succeed when they receive guidance that is tailored to their current level of understanding. For MN and LN, this suggests that instructional methods need to provide scaffolded support to build critical thinking skills before personal context can enhance learning outcomes. In addition, motivation is another significant factor to consider, as students' engagement with contextualized problems depends on how relevant and accessible the tasks are to them. LN's struggle with basic calculations points to a need for more foundational support, as mathematical reasoning cannot be effectively applied without mastery of basic numeracy operations (Hidayah et al., 2021).

Moreover, the study found that contextual familiarity played a significant role in students' ability to solve problems. HN, who demonstrated high numeracy, was more likely to recognize the relevance of the problem and apply mathematical reasoning effectively. In contrast, LN, despite the contextual relevance of the problem, struggled to make connections, indicating that familiarity with similar tasks significantly influences problem-solving abilities (Abylkassymova et al., 2024). This suggests that familiarity with the problem context could reduce cognitive load and improve performance, especially for lower-ability students. In line with the findings of (Abylkassymova et al., 2024), it is important to recognize that the level of familiarity with certain types of problems can affect students' ability to solve them. For LN students, the lack of familiarity with the types of real-life scenarios presented in the MCA tasks likely led to difficulties in interpreting and solving the problems. If problems were based on culturally familiar scenarios, such as budgeting for local community events or managing household expenses, LN students might have found the tasks more relatable and engaging, potentially improving their performance.

However, biases in the students' familiarity with the problem context should also be considered. For instance, students from backgrounds where they have more exposure to financial decision-making or spatial reasoning tasks may find the MCA problems easier to relate to and solve. As noted by (Hidayah et al., 2021), students' prior experiences and the sociocultural context can influence their numeracy abilities, highlighting the importance of considering socioeconomic and cultural factors when designing educational assessments.

While personal context in mathematics problems can be engaging, it is essential to consider the cultural relevance of these contexts. For instance, students who have not encountered the specific scenarios described in the problems might struggle to connect with them. In the present study, LN students might have faced challenges because the tasks involved scenarios that were culturally unfamiliar to them. For example, tasks related to calculating areas of ceramic shapes and matching them with prices may not have resonated with students from more rural or lower-income backgrounds, who might have less experience with such practical applications of geometry in everyday life. When students are presented with problems that align with their cultural or community experiences, they are more likely to see the relevance and engage with the task effectively. Furthermore, research by (Schoenherr, 2024) highlights that familiarity with context can improve student engagement and performance in mathematics. In this case, LN students, who may not have had exposure to the types of real-world problems presented in the tasks, were likely unable to make the connection between the mathematical concepts and their everyday lives. This suggests that future teaching strategies should consider incorporating more relatable examples, such as local scenarios involving everyday objects or practical applications like home renovation or personal finances, to help students connect geometric concepts to real-life situations. By doing so, students who struggle with more abstract or unfamiliar tasks can better engage with and understand the mathematical reasoning required to solve such problems.

To address these concerns and deepen the theoretical engagement, it is crucial to emphasize that personal context is not a one-size-fits-all solution. While it can enhance motivation and relevance, its effectiveness hinges on students' numeracy foundations (Lindström-Sandahl et al., 2024). For example, students with strong numeracy skills like HN can immediately make the connection between abstract problems and real-world applications. However, for students with lower numeracy levels, personal context can only serve as an additional bridge if foundational skills are solidified first. In addition, while personal context has proven beneficial for students with strong numeracy abilities, the findings suggest that context alone is insufficient to support students at all ability levels. Students with medium and low numeracy levels need more comprehensive support in developing both foundational skills and the ability to apply them to real-world situations. This approach will foster a holistic understanding of numeracy, ensuring students not only perform mathematical calculations correctly but also understand how to apply those results effectively in their daily lives.

The varying responses from HN, MN, and LN highlight the need for differentiated instructional approaches that address students' specific numeracy challenges. For students like MN who demonstrate procedural knowledge but struggle with application, educators should focus on strengthening the connection between mathematical operations and their practical significance. This could involve guided practice in translating numerical results into meaningful decisions and explicit instruction on how mathematical concepts manifest in everyday scenarios. For students like LN who face fundamental difficulties, a more structured approach is necessary, beginning with building confidence in basic calculations before introducing contextual applications. The significant gap between HN's comprehensive numeracy skills and LN's limited abilities suggests that assessment tools like the MCA can effectively identify where targeted interventions are most needed.

The small sample size limits the generalizability of the results to a larger student population, and the school selection may have introduced bias regarding the types of students who were included in the study. The lack of diversity in problem types is another limitation, as the study primarily focused on algebra and geometry, and future research could include a broader range of mathematical domains to test the applicability of these findings across different contexts. Furthermore, while the use of personal context in the MCA proved beneficial for higher-performing students, the study suggests that more differentiated instruction is needed to effectively address the varied needs of students at different numeracy levels. In light of these limitations, future research should explore the role of motivational and instructional factors in numeracy development, particularly for students who struggle with foundational skills. Longitudinal studies that track students' progress in mastering basic numeracy skills and applying them to real-world contexts would provide valuable insights into how instructional strategies can evolve to better meet the needs of diverse learners. Further studies could also examine the impact of socio-cultural factors on students' engagement with context-based problems, as prior experiences and cultural exposure may influence how students interpret and solve numeracy problems.

CONCLUSION

This study aimed to analyze eighth-grade students' numeracy skills in solving problems with personal contexts in the Minimum Competency Assessment (MCA). The findings revealed that students' performance was influenced not only by their mathematical abilities but also by how effectively they could connect abstract mathematical concepts to real-world contexts. High-performing students (HN) were able to apply mathematical reasoning to contextualized problems, while medium and low-performing students (MN and LN) struggled to apply basic numeracy skills to these tasks. Although personal context has the potential to engage students, its effectiveness is closely linked to the students' foundational numeracy skills. For high-performing students, personal context proved beneficial, helping them relate abstract concepts to practical situations. However, for students with lower numeracy levels, personal context alone was insufficient to improve their performance; it needed to be supported by a strong foundation in numeracy skills.

Based on these findings, several pedagogical implications emerge. Curriculum developers should create real-life, culturally relevant contexts that connect with students' everyday experiences, such as budgeting or community planning. Teachers should adopt differentiated instruction, providing scaffolded support based on students' numeracy levels, with more complex tasks for high-performing students and foundational skill reinforcement for those with lower levels. Formative assessments can guide instructional adjustments. For assessment designers, numeracy tasks should be designed to engage students across ability levels, with scaffolding to ensure accessibility for all. The study also contributes to the design of numeracy tasks in national assessments, suggesting that personal context should be used strategically, considering students' foundational skills. Future research should explore the impact of sustained exposure to contextualized problems and the role of technology in supporting differentiated learning. Despite limitations such as a small sample size, the study offers valuable insights for improving educational practices. By integrating these recommendations into curriculum, teaching, and assessments, we can better support students at varying numeracy levels, enhancing their ability to solve real-world problems.

RECOMMENDATION

Based on the findings of this study, it is evident that the effectiveness of contextual problems in numeracy assessment is strongly influenced by students' foundational numeracy skills. Students with strong basic numeracy are able to utilize personal contexts to solve problems more meaningfully, while those with weaker foundational skills tend to struggle even when the problems are related to their daily lives. Therefore, the intervention proposed in this research emphasizes the importance of a dual-path approach. The first path focuses on strengthening foundational numeracy skills through arithmetic practice, number sense development, and the use of mathematical symbols. The second path involves integrating contextual or personal problems that are relevant to students' everyday experiences, aiming to enhance engagement and the real-world application of mathematics. This dual-path intervention framework highlights that both components must work in tandem. By simultaneously reinforcing basic numeracy and embedding mathematics in meaningful contexts, students are expected to develop critical thinking, apply mathematical concepts more effectively, and remain engaged across all levels of ability.

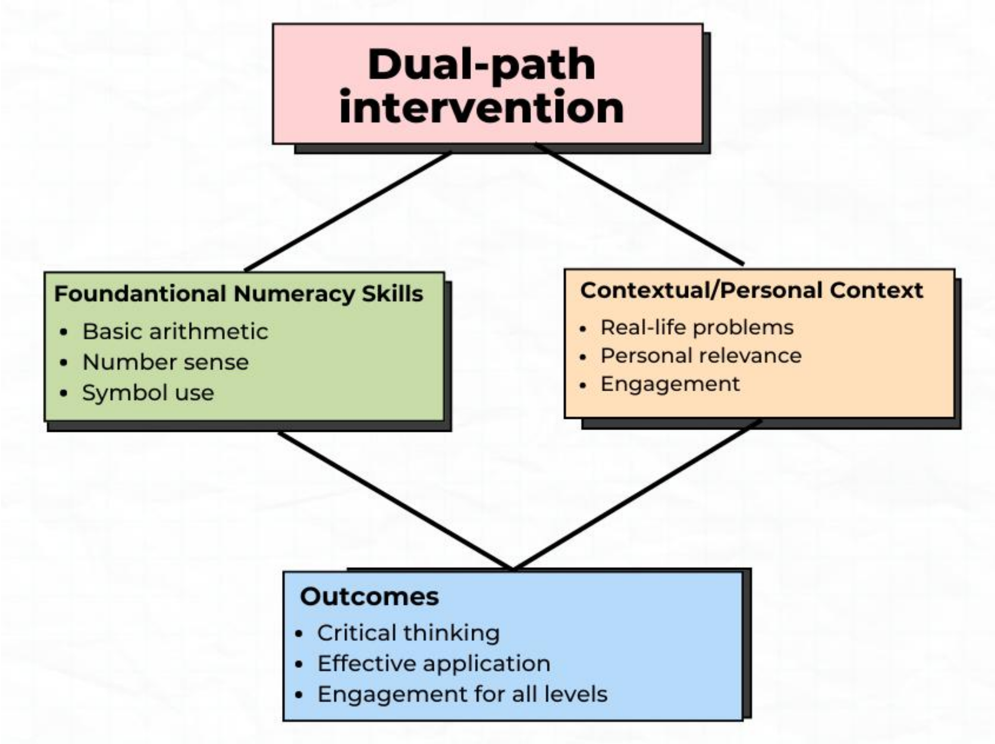

Figure 13. Dual-path intervention framework for enhancing numeracy skills

However, this study has several limitations. First, the small sample size limits the generalizability of our findings. Second, the personal contexts used in the assessment may not have been equally relevant to all participants due to their diverse backgrounds and experiences. These limitations suggest that while personal context in mathematics problems can be engaging, it is essential to consider the cultural relevance of these contexts. Future studies should explore whether cultural relevance plays a more significant role in student engagement and problem-solving, particularly for students from diverse backgrounds.

In light of these findings and limitations, several strategic directions are proposed to strengthen the implementation of the Minimum Competency Assessment (MCA) in enhancing students' numeracy skills. Future curriculum development should focus on creating contextualized problems that are relevant and accessible to all students, irrespective of their socio-economic background. Further research is needed to explore how personal contexts may affect students from diverse cultural backgrounds or those with less exposure to certain problem types, particularly in assessments like the MCA.

Furthermore, teachers should adopt differentiated instruction, tailoring tasks to each student's level of understanding. High-performing students can engage with more complex problems, while those with lower numeracy levels should first solidify foundational skills. Formative assessments can help guide instruction and identify gaps in student understanding. In this regard, assessment designers should ensure that numeracy tasks cater to varying ability levels, with scaffolding to help students gradually apply mathematical reasoning in real-world contexts. Tasks should be both challenging and accessible for all students. By implementing these strategies, educational practices can better support students at different numeracy levels, fostering deeper engagement and improving their ability to solve real-world problems.

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