PRISMA, 14(2), 281-293, December 2025
https://jurnal.unsur.ac.id/prisma
DOI:10.35194/jp.v14i2.5348

p-ISSN 2089 3604
e-ISSN 2614 4611

Students' Numeracy Skills in Solving Minimum Competency Assessment Questions on Geometry and Measurement Content

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Submitted: 04-06-2025	*Revised*: *10-11-2025*	*Accepted: 20-11-2025*	*Published: 05-11-2025*

ABSTRACT

The Minimum Competency Assessment (MCA) measures students' numeracy skills, a crucial ability in the 21st-century digital era. However, PISA and the 2024 Indonesian Education Report show that Indonesian students' numeracy skills remain low. This study aims to describe students' numeracy skills in solving MCA questions on geometry and measurement content. The method used is descriptive with a qualitative approac. Data were collected through triangulation involving test results from seven MCA numeracy questions on geometry and measurement and through interviews. The subjects of this study consisted of 32 eighth-grade students from SMPN 40 Pekanbaru. The analysis of students' answers revealed that 46.88% were categorized as low, 43.75% as moderate, and only 9.38% demonstrated a high level of numeracy proficiency. Interviews were conducted with selected students based on the results of the response analysis. Students in the high category were able to understand the context, interpret visual information, and apply reasoning and geometric concepts to real-life situations. They demonstrated the full range of cognitive processes, although improvements in accuracy are still needed. Students in the moderate category showed a lack of systematic thinking and often missed key details due to insufficient attentiveness when reading questions and selecting strategies. Meanwhile, students in the low category experienced fundamental difficulties in understanding visual information, units, and problem contexts. Their responses tended to be based on guesses rather than logical calculation, indicating the need for intensive support and more foundational instruction.

Keywords: geometry; measurement; minimum competency assessment; numeracy skills

INTRODUCTION

Numeracy is a critical competency in the digital era of the 21st century (Baharuddin, 2021; Puspitasari et al., 2024; Rosidah & Ekawati, 2023; Siskawati et al., 2021). Numeracy skills do not merely refer to arithmetic abilities but encompass the capacity to interpret, analyze, and utilize relevant information across various real-life contexts. Ministry of Education, Culture, Research (2020) defines numeracy as the ability to apply mathematical concepts, procedures, facts, and tools to solve real-life problems across various relevant contexts, meanwhile, King & Purpura (2021) emphasize that numeracy involves understanding and applying number concepts and mathematical symbols presented in multiple forms of representation such as graphs, tables, or charts to address real-life problems.

Numeracy is a core component of mathematical competence assessed in the PISA framework, as both emphasize the understanding, application, and reasoning of mathematics in real-life contexts, however, the 2018 international PISA study revealed that the average mathematics score of Indonesian students was 379, which is significantly below the OECD

average of 489. This score further declined in 2022, with Indonesian students achieving an average of 366 (OECD, 2023). These findings underscore the urgent need for a more comprehensive mapping of students' mathematical abilities at the national level. In response, the Government of Indonesia has implemented the National Assessment to measure students' numeracy competence. This initiative aims to obtain more contextualized information on student achievement and to provide relevant feedback for evaluating the education system and informing future program planning (Center for Assessment and Learning, 2021)

The Minimum Competency Assessment is a component of the National Assessment that evaluates the numeracy skills of Indonesian students (Ministry of Education, Culture, Research, 2021). The achievement of students' numeracy skills in Indonesia is published annually in the Indonesian Education Report as part of ongoing efforts to monitor and evaluate the quality of national education. The 2024 Indonesian Education Report indicates that only 53.45% of junior secondary students (SMP/MTs/equivalent) in Indonesia have achieved the expected level of numeracy competence, while only 55.30% of senior secondary students (SMA/MA/equivalent) have reached the expected level (Center for Educational Assessment, 2024).

One of the content areas assessed in the Minimum Competency Assessment is geometry and measurement. The scope of the material includes the introduction of plane figures as well as the measurement of length and time (Ministry of Education, Culture, Research, 2020). A strong understanding of geometry supports students in developing thinking skills, processing information logically, and connecting interrelated concepts to solve real-life problems (Kurniawan et al., 2024; Rahmi et al., 2023; Zamzaili et al., 2023). Van de Walle identified several key reasons for studying geometry: it plays a central role in other branches of mathematics, exploration in geometry fosters problem-solving skills, and geometry is widely applied to real-life problems (Salsabilah et al., 2023). Based on the explanation above, it can be concluded that geometry is essential for students to solve real-life problems. However, Indonesian students' numeracy skills related to geometry and measurement remain relatively low, as shown in several studies. Research conducted by Wati & Nurcahyo (2023) found that 9.5% of students were at the level requiring special intervention, 81% were at the basic level, 4.75% were at the proficient level, and 4.75% were at the advanced level of numeracy competence. Similarly, a study by Ali & Ni'mah (2023) revealed that 78% of students were classified as having low numeracy skills based on test scores. Students struggled to interpret geometric problems and encountered difficulties in solving problem-solving tasks related to various real-life contexts.

Students' numeracy skills in solving MCA questions on geometry and measurement need to be analyzed to provide accurate information on their level of mastery of geometric concepts and their applications to real-life situations. The findings of this study can serve as a reference for teachers in designing instruction that supports the continuous improvement of students' numeracy competence.

RESEARCH METHODS

This study used a descriptive qualitative approach, which aims to describe students' numeracy skills in solving MCA questions of geometry and measurement content. The research subjects were eighth-grade students from class VIII E at SMPN 40 Pekanbaru. The data collection techniques used were tests and interviews. The data analysis technique consisted of three stages. The first stage was data reduction, which aimed to simplify and focus the collected data. The second was data presentation, which helped facilitate the analysis process. The final stage was drawing conclusions, which was carried out to gain a meaningful understanding of the findings.

The test instrument used in this study consisted of seven MCA numeracy questions developed by the Ministry of Education. These questions were analyzed based on content, context, and cognitive processes. Questions that met the geometry and measurement content criteria, personal, socio-cultural, scientific contexts, and cognitive processes involving understanding, application, and reasoning were selected. The selected MCA questions were then modified regarding item type to provide variation in question formats. The MCA questions included multiple-choice, complex multiple-choice, matching, and open-ended questions. The mapping of MCA questions based on context and cognitive processes is presented in Table 1.

Table 1. Mapping of MCA Questions

Question	Context	Cognitive Process
1	Personal	Applying
2	Personal	Reasoning
3	Socio Cultural	Applying
4	Socio Cultural	Reasoning
5	Personal	Understanding
6	Scientific	Applying
7	Scientific	Reasoning

The stages of this study began with administering a numeracy test based on MCA questions to 32 students in class VIII E. Students' answers were analyzed using the answer key developed by the Ministry of Education. Based on the analysis results, students' test scores were classified into three categories of numeracy skills, namely high, moderate, and low. Interviews were conducted with several students selected based on the analysis of their answers. The interview data provided a more comprehensive overview of students' numeracy skills in solving MCA questions related to geometry and measurement content.

RESULTS AND DISCUSSION

Table 2 presents the distribution of students based on numeracy skills categories to provide an overview of students' numeracy proficiency levels.

Table 2. Categories of Students' Numeracy Skills

Score Range	Category	Frequency	Percentage (%)
$81 \leq x \leq 100$	High	3	9.38
$66 \leq x \leq 80$	Moderate	14	43.75
$0 \leq x \leq 65$	Low	15	46.88

Table 2 shows the classification of students' numeracy skills according to score ranges. Most students fall into the low category. A total of 15 students (46.88%) were classified as having low numeracy skills, 14 students (43.75%) were in the moderate category, and only 3 students (9.38%) demonstrated high numeracy skills. These findings indicate that 90.63% of students possess numeracy skills within the low to moderate range. The students' numeracy skills achievement based on context and cognitive process is presented in Table 3.

Table 3. Numeracy Skills Achievement

Aspect		Percentage (%)
Context	Personal	49,8
	Scientific	42,7
	Socio Cultural	37,3
Cognitive Process	Understanding	60,1
	Applying	47,8
	Reasoning	35,3

Based on Table 3, in terms of context, students performed best in the personal context with an achievement rate of 49.8%, followed by the scientific context at 42.7%, and the lowest performance was observed in the socio cultural context at 37.3%. Regarding cognitive processes, the highest achievement was recorded at the understanding level at 60.1%, followed by applying level at 47.8%, and the lowest at the reasoning level at 35.3%.

Results Based on Context

The following section discusses the analysis of students' numeracy skills in solving MCA problems within the content of geometry and measurement based on the problem context.

Personal Context

The following section presents question stimuli with a personal context and an analysis of students' answers. Figure 1 presents a personal context in question 1.

Village Park Construction

Mr. Agung owns a business in landscape design and construction. One day, the villagers asked Mr. Agung to build a village park. Before the construction, Mr. Agung prepared a detailed design plan for the park.

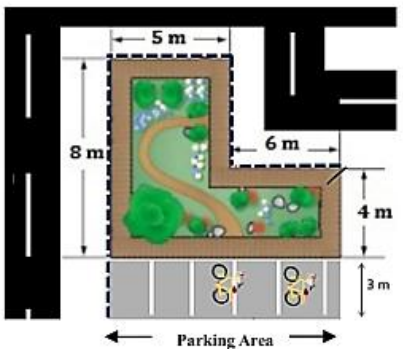


Figure 1. Personal Context in Question 1 and 2

Figure 1 presents a problem in a personal context, specifically the garden design process by Mr. Agung, who runs a business in garden construction. This context is considered personal because it closely relates to students' everyday experiences, such as having seen, visited, or even participated in similar activities within their local environment, including village parks, school gardens, or green spaces near their homes.

The analysis of students' answers indicates that only high category students were able to accurately identify visual information from the personal context, particularly regarding the sides of the garden and the parking area, including the need to consider boundaries and assess the space requirements for vehicles in the parking area. They were also able to relate this information to real life needs. Based on interview results, high category students demonstrated the ability to connect the required space per vehicle with the total available area, reflecting logical thinking grounded in a personal context. In contrast, students in the moderate category were only able to understand part of the information due to rushing through the question, which led them to overlook important details. Meanwhile, students in the low category responded based on guesswork rather than thoroughly analyzing the information presented in the personal context problem.

Figure 2 presents a personal context in question 5.

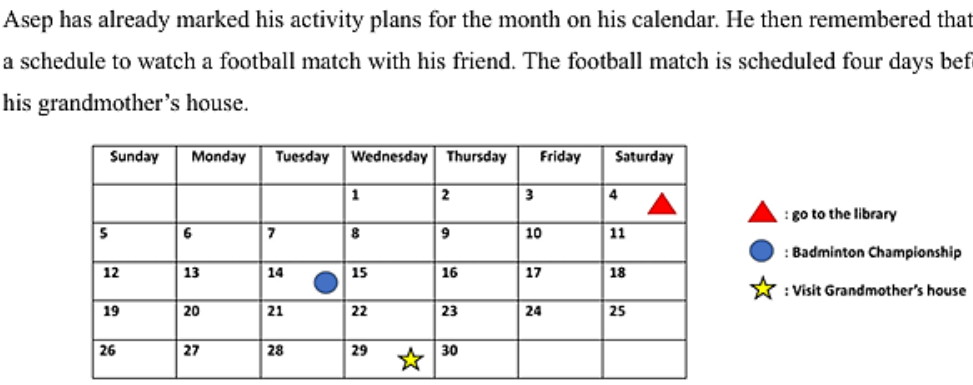


Figure 2. Personal Context in Question 5

Figure 2 presents an MCA problem set in a personal context, specifically involving interpreting and understanding a personal schedule marked on a calendar. The analysis of students' answers shows that high category students and moderate category students were able to identify relevant information from the figure showing Asep's activity schedule and accurately calculate the time intervals. In contrast, low category students were unable to correctly interpret the information from the figure within the personal context. Based on interview results, high category students initially experienced confusion when calculating the time intervals between activities, however, they were eventually able to draw accurate conclusions regarding the problem rooted in a personal context.

Scientific Context

The following section presents a question stimulus with a scientific context and an analysis of students' answers. Figure 3 presents a scientific context in questions 6 and 7.

Floating Hospital

Indonesia is known as an archipelagic country. Many of its smaller islands lack access to adequate healthcare facilities. In response to this issue, a group of doctors initiated establishing a floating hospital, enabling residents of remote islands to receive proper medical care. The floating hospital serves several small islands along its route of operation. The image below shows the travel route of the floating hospital to various islands.

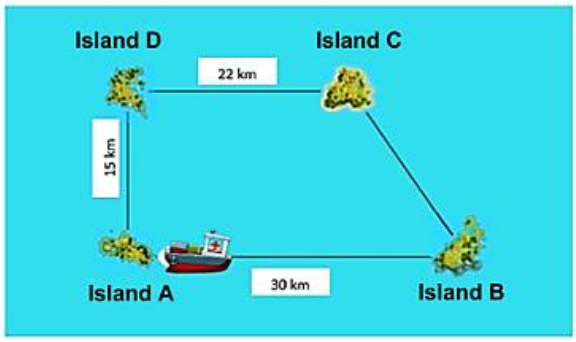


Figure 3. Scientific Context in Question 6 and 7

Figure 3 presents an MCA problem set in a scientific context, specifically addressing disparities in access to healthcare services across Indonesia's archipelagic regions. This issue is directly related to scientific facts indicating that many small islands lack adequate medical facilities. The proposed solution in the form of floating hospitals represents a science- and technology-based response to these geographical challenges. The analysis of students' answers shows that high category students and moderate category students were able to accurately analyze the distances between islands, a critical competency for designing logistics in healthcare services using floating hospitals. In contrast, low category students did not perform any analysis.

Interview results revealed that high category students were able to identify relevant information from the map and select appropriate and systematic problem-solving strategies within the scientific context. Moderate category students demonstrated confusion in choosing the correct strategy, while low category students failed to conduct any systematic calculations and ultimately guessed the answers without sufficient analytical reasoning or proper computation. These findings are consistent with Fauzi et al. (2021) that students struggle to construct appropriate solution strategies due to low reasoning skills.

Socio Cultural Context

The following section presents a question stimulus with a socio cultural context and an analysis of students' answers. Figure 4 presents a socio cultural context in questions 3 and 4.

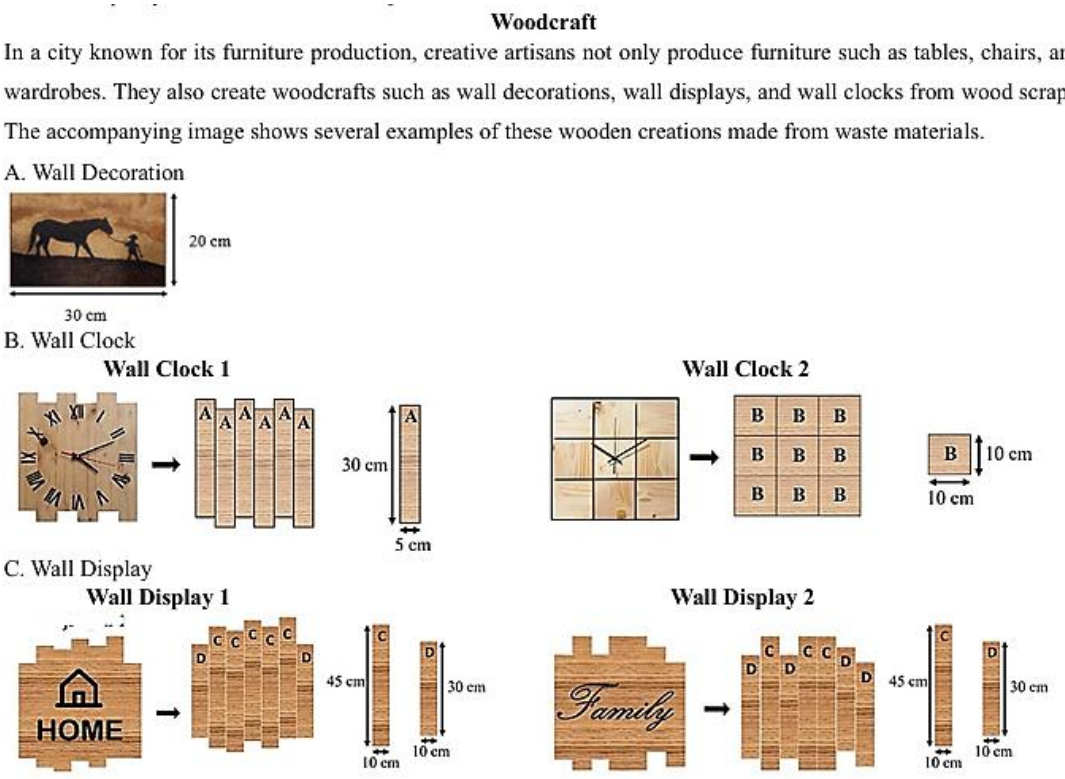


Figure 4. Socio Cultural Context in Question 3 and 4

Figure 4 presents an MCA problem set in a socio cultural context, specifically involving transforming wood waste into functional and aesthetic products that reflect creativity and local wisdom. Students must analyze the components that make up a craft product from wood pieces, as artisans practice in real-life situations. The analysis of students' answers shows that high and moderate category students were able to connect information about the stock of wood materials with the production process of wall clocks. However, none of the students were able to relate the information about the wood material stock to the production process of wall decorations, which in real-life settings is a crucial aspect of sustaining local businesses. Based on interview results, high category students understood that artisans consider the total surface area when determining material needs for creating wall clocks, reflecting systematic and efficient thinking practiced by entrepreneurs grounded in local culture. In contrast, moderate category students and low category students tended to memorize concepts without understanding the meaning of the context, resulting in answers that were not based on a meaningful interpretation of the socio-cultural context presented in the problem.

Based on the analysis of students' achievement across various contexts in MCA problems within the content of geometry and measurement, it was found that problems involving personal contexts, such as the existence of gardens in residential areas or the use of calendars to organize daily activities represent a direct application of geometric and measurement concepts. These types of problems produced the highest levels of achievement, reflecting logical thinking skills that are strengthened by the closeness of the context to students' real life experiences. In contrast, the lowest performance was found in socio cultural contexts, indicating that students encountered difficulties in understanding problems that contained cultural values and aspects of local wisdom. These findings align

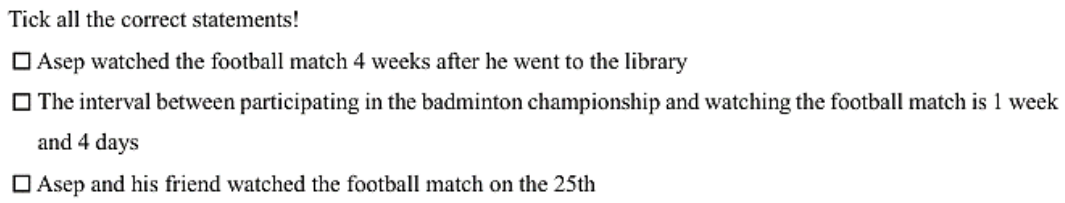
with the findings of Hastuti & Setyaningrum (2023) that students struggle when presented with non routine problems or problems embedded in socio cultural context.

Results Based on Cognitive Process

The following discussion elaborates on the analysis of students' numeracy skills in solving MCA problems within the content of geometry and measurement based on the cognitive processes assessed in the problems.

Understanding Level

The following section presents a numeracy question with an understanding level and an analysis of students' answers. Figure 5 presents an understanding level in question 5.


Tick all the correct statements!

☐ Asep watched the football match 4 weeks after he went to the library

☐ The interval between participating in the badminton championship and watching the football match is 1 week and 4 days

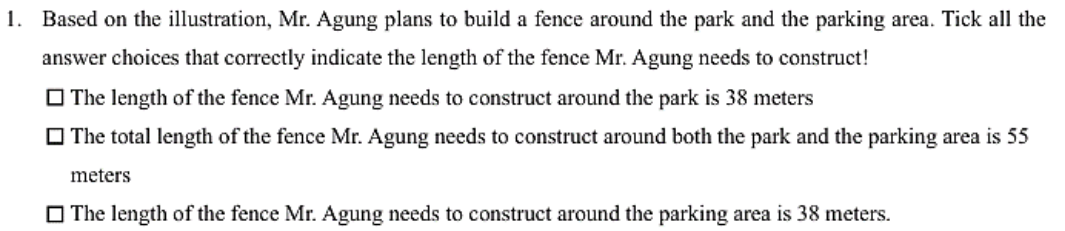
☐ Asep and his friend watched the football match on the 25th

Figure 5. Understanding Level in Question 5

Figure 5 presents an MCA problem that requires students to understand the temporal relationships between events. The analysis of student answers shows that high and moderate category students demonstrated a solid understanding of the information presented, successfully identified the connections between events, and accurately calculated the timing of various activities. As a result, they were able to select all correct statements. In contrast, low category students failed to fully comprehend the information from the figure, leading to errors in identifying the correct statements. These findings are consistent with Setianingsih et al. (2022) that students still experience difficulties in identifying information presented in figures, graphs, tables, and similar formats. Interview results further support this conclusion, indicating that although high category students experienced some initial confusion, they were ultimately able to draw accurate conclusions.

Applying Level

The following section presents numeracy questions with an applying level and an analysis of students' answers. Figure 6 presents an applying level in question 1.


1. Based on the illustration, Mr. Agung plans to build a fence around the park and the parking area. Tick all the answer choices that correctly indicate the length of the fence Mr. Agung needs to construct!

   ☐ The length of the fence Mr. Agung needs to construct around the park is 38 meters

   ☐ The total length of the fence Mr. Agung needs to construct around both the park and the parking area is 55 meters

   ☐ The length of the fence Mr. Agung needs to construct around the parking area is 38 meters.

Figure 6. Applying Level in Question 1

Figure 6 presents an MCA problem that requires students to apply their knowledge of the perimeter of two dimensional shapes. The analysis of student answers shows that only

high category students were able to apply the concept of perimeter correctly. In contrast, moderate and low category students made conceptual errors by calculating the fence length using the procedure for finding the area rather than the perimeter. Interview results revealed that moderate and low category students were still unable to distinguish between the application of area and perimeter concepts. This difficulty stemmed from a tendency to memorize geometric formulas without understanding their contextual application. These findings are consistent with Enjelia et al. (2024) that students struggled to draw correct conclusions because they were unable to apply appropriate strategies to solve problems and failed to use the correct concepts within their proper context.

Figure 7 presents an applying level in question 3.

3. An artisan created two models of wall clocks. Based on this, tick whether the following statements are true or false!

Statement	True	False
The construction of Wall Clock 1 requires a wooden board with an area of 900 cm^2		
The construction of Wall Clock 2 requires a wooden board with an area of 1.000 cm^2		

Figure 7. Applying Level in Question 3

Figure 7 presents an MCA problem that requires students to apply their knowledge of the area of two dimensional shapes. The analysis of student answers shows that only high category students were able to apply the concept of area correctly. In contrast, moderate and low category students made errors in applying the concept by calculating the wooden board requirements for creating a wall clock using the procedure for determining the perimeter of two-dimensional shapes. Interview results revealed that moderate category students and low category students were still unable to distinguish between the application of area and perimeter concepts. This condition is caused by students' tendency to rely on memorizing geometric formulas without a deep understanding of their contextual application. These findings align with the findings by Tata & Haerudin (2022) that students tend to memorize formulas without understanding how to apply them in context.

Figure 8 presents an applying level in question 6.

6. Based on the map of the floating hospital's route, what is the distance traveled by the floating hospital from Island B to Island C? Cross out the correct answer!

a. 10 km b. 17 km c. 18 km d. 22 km

Figure 8. Applying Level in Question 6

Figure 8 presents an MCA problem that requires students to apply the Pythagorean Theorem. The analysis of student answers shows that high and moderate category students were able to correctly apply the Pythagorean Theorem to calculate the distance between Island B and Island C on the floating hospital map provided. Interview results revealed that low category students did not know the appropriate problem solving strategy. Instead, they added the distances between the islands. Even though their calculations did not match any available answer choices, low category students selected the option closest to their calculation result.

Reasoning Level

The following section presents numeracy questions with a reasoning level and an analysis of students' answers. Figure 9 presents a reasoning level in question 2.

2. Mr. Agung was requested to design a parking area for cars and motorcycles. From the available parking space, he was asked to allocate enough area for 2 (two) cars. Each car requires an area of 9 m², assuming a maximum car length of 3 meters. Meanwhile, each motorcycle requires 1.5 m² of space. Mr. Agung was instructed to design the parking area to accommodate 10 motorcycles.

   Based on this information, tick whether the following statements are true or false!

Statement	True	False
The car parking area is designed to measure 3 m × 6 m to fit 2 cars		
After allocating car space, the remaining area is insufficient to accommodate 10 motorcycles		

Figure 9. Reasoning Level in Question 2

Figure 9 presents an MCA problem requiring students to reason through the validity of a statement by calculating and comparing the parking lot capacity available for each type of vehicle. The analysis of student answers shows that only high category students were able to accurately reason through the parking capacity for 2 cars and 10 motorcycles. Interview results revealed that moderate category students were unable to fully connect all pieces of information due to rushing through the question, while low category students failed to understand the relationship between the space required for each vehicle and the total available parking area. Their conclusions were based on guesses rather than analytical reasoning.

Figure 10 presents a reasoning level in question 4.

4. An artisan received an order to make one Wall Display 1 and one Wall Display 2. However, the artisan only has enough wood stock to produce two units of Wall Display 1. Is the available wood stock sufficient to fulfill the order? Provide a clear explanation!

Figure 10. Reasoning Level in Question 4

Figure 10 presents an MCA problem that requires students to reason about whether the available materials are sufficient to fulfill a given order. The analysis of student answers indicates that all students experienced difficulties reasoning through the information presented in the figure and contextual problem. Interview results revealed that high category students were able to analyze information related to the available wood stock but made calculation errors due to a lack of carefulness. Meanwhile, moderate category students assumed that all wooden components for the wall decoration were of equal size, and low category students equated the entire stock of wood with the amount needed to produce just one decoration. This confusion stemmed from their unfamiliarity with solving word problems that integrate narrative and visual information, leading to difficulties connecting the figure with the written context. These findings are consistent with Puspitasari et al. (2024) that one of the factors contributing to students' low numeracy skills is their lack of experience with non routine problems, especially problems presented in the form of contextual problems and visual formats such as figures, graphs, and tables.

Figure 11 presents a reasoning level in question 7.

7. The service at each island lasts for 1.5 hours, and the floating hospital usually begins operating at 08.00 AM from Island A. Match the hospital's arrival time at each island with the corresponding average speed!

Travel Information	
From Island A, the floating hospital arrives at Island D at 09:45 AM	●
From Island A, the floating hospital arrives at Island C at 11:49 AM	●

Average Speed	
●	75 km/h
●	60 km/h
●	45 km/h

Figure 11. Reasoning Level in Question 7

Figure 11 presents an MCA problem that requires students to reason through the relationship between travel time, service duration, and average speed to determine the arrival time of a floating hospital. The analysis of student answers shows that high category students were able to connect information obtained from the map with the context of the problem. In contrast, moderate category students accurately analyzed the distance between islands but became confused when determining the problem-solving steps, and as a result, they did not perform the necessary calculations and answered randomly without analytical reasoning. Interview results revealed that moderate and low category students were unable to explain their problem-solving strategies and did not demonstrate a systematic line of reasoning.

Based on the analysis of students' performance related to the cognitive processes measured in the MCA problems, the highest achievement was found in understanding level, indicating that most students were able to comprehend the information presented. In contrast, the reasoning level showed the lowest achievement, indicating that many students had difficulty linking complex pieces of information, especially when they needed to interpret visual elements alongside narrative content at the same time.

CONCLUSION

Based on the analysis conducted on students' numeracy skills in solving Minimum Competency Assessment questions on geometry and measurement content, it can be concluded that most students are still at a low level of numeracy proficiency. 46.88% of students were categorized as low, 43.75% as moderate, and only 9.38% demonstrated numeracy skills at the high category level. There are differences based on context and cognitive processes assessed in MCA questions across student categories. High category students demonstrated strong contextual comprehension, particularly in geometry and measurement content. They were able to engage in a complete range of cognitive processes, from understanding and applying to reasoning effectively. However, they must improve their accuracy to optimize their final results. Moderate category students were able to grasp parts of the context but struggled to think systematically and accurately when solving complex problems. They tended to be less thorough in reading the problem and selecting appropriate problem-solving strategies, affecting their process and results. Meanwhile, low category students had not mastered basic skills in interpreting visual information, understanding measurements, or integrating cognitive processes. Their answers were often based on guesses, lacking contextual understanding and valid reasoning.

Following the identification of students' numeracy skill levels, teachers are expected to design instructional strategies and assessments aligned with students' skill levels. It is essential for teachers to routinely engage students in solving numeracy questions that

incorporate both textual information and visual elements such as pictures, graphs, and tables. Teachers or other researchers can develop assessments to enhance students' numeracy skills, particularly in geometry and measurement content. Further research is crucial to identify more effective teaching approaches to address students' challenges and gain deeper insights into the factors influencing students' numeracy skills in geometry and measurement content across various educational stages.

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