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STUDENTS' STRATEGIES AND CREATIVITY IN SOLVING MATHEMATICAL LITERACY PROBLEMS

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ABSTRACT

This study aims to describe students' strategies and creativity in solving mathematical literacy problems. Mathematical literacy requires students not only to understand mathematical concepts but also to select appropriate problem-solving strategies and apply creative thinking in various contexts. Therefore, understanding how students use strategies and demonstrate creativity in solving mathematical literacy problems becomes important. The research employed a qualitative descriptive method involving junior high school students who were categorized into high, medium, and low ability levels based on the results of a mathematical literacy problem-solving test. The main instruments were the researchers themselves, while the supporting instruments included a mathematical literacy test, interview guidelines, and validation sheets. Data were collected through two stages of testing and two stages of interviews, and triangulation was employed to ensure data validity. In addition, triangulation across methods and time was employed to enhance the validity of the data. The results showed that students demonstrated different strategies and levels of creativity in solving problems. Students in the high-ability category were able to understand problems well, choose appropriate strategies, and exhibit all indicators of creativity—fluency, flexibility, and novelty. Medium-ability students showed fluency and novelty or flexibility and novelty, while low-ability students generally did not meet any creativity indicators due to difficulties in understanding the problems and selecting proper strategies.

Keywords: Mathematical Literacy, Problem Solving, Strategies, Creativity

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PRELIMINARY

According to the Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi (2023), although various educational reforms and policy initiatives have been implemented, improving the quality of education and ensuring equitable access across regions in Indonesia remain major challenges. One indicator that is often used to assess the quality of education is the results of the Programme for International Student Assessment (PISA). In 2018, the average scores of Indonesian students in reading, mathematics, and science were still below the average of the Organisation for Economic Co-operation and Development (OECD) (Siswanto & Meiliasari, 2024). These results indicate the need for improvements in the

national education system, particularly in the mastery of fundamental subjects such as mathematics.

Mathematics plays a crucial role in the education curriculum because it not only serves as a basic science, but also trains logical, analytical, and systematic thinking skills. These skills are essential for students to deal with various complex problems in everyday life (Kilpatrick & Findell, 2001). Furthermore, mathematics forms the foundation for mastering other sciences and technologies, making effective mathematics teaching in schools extremely important (Setyaningsih & Fatimah, 2022).

The education curriculum in Indonesia has undergone several changes, with the aim of adapting to the times and the needs of society. One of these changes is the independent curriculum, which aims to provide flexibility for educational units in developing relevant and contextual learning processes. However, in practice, there are still various obstacles, especially in mathematics learning (Salwa et al., 2025). One of the main problems is the teacher-centred approach to learning, which results in students being less active and creative in the learning process (Herdianto et al.,2024). In addition, limited facilities and infrastructure, as well as variations in student abilities, pose additional challenges to the effective implementation of the curriculum.

Mathematical problem-solving skills are one of the competencies that are expected to be achieved through learning. However, in reality, many students still struggle to solve mathematical problems, especially non-routine problems or those that require higher-level reasoning. The causes are a lack of practice and familiarity with challenging problems, as well as a lack of variety in teaching methods. This results in many students tending to memorise formulas without understanding the basic concepts, so that when given problems that are different from previous examples, students experience difficulties. To overcome this problem, students need to be creative in applying mathematical concepts to various contexts (Mulbar et al., 2024). In addition, learning approaches that link mathematics to cultural contexts or ethnomathematics have been shown to improve students' problem-solving skills and creativity (Nur et al., 2020).

Mathematical literacy, which includes the ability to understand, analyse, and apply mathematical concepts in various contexts, should be an important focus in efforts to improve the quality of education. To overcome problems in mathematical literacy, creative and contextual learning approaches are essential (Mulbar et al., 2023). Context-based learning has been proven effective in improving students' mathematical literacy because it helps them understand the application of concepts in real life (Fatkurochman et al., 2024).

In problem solving, it is also necessary to choose the right strategy to make it easier for students to understand and obtain an overview of the problems they face.

Strategy and creativity in mathematics learning have a significant influence on students' problem-solving abilities. Critical thinking skills are an important aspect of students' creativity when solving mathematical problems (Suryawan et al., 2023). According to Polya (Polya, 1973), problem-solving abilities depend on the ideas behind the plan. Orton, in his book, mentions that the most difficult and complex stages are stage 2 (problem decision - solution plan decision) and stage 3 (work), especially stage 2, which requires creativity, insight, and deep understanding (Orton, 1992).

Based on the previous description, researchers are interested in further examining various strategies and creativity in learning that can improve students' literacy skills. A deep understanding of these strategies is expected to contribute positively to the development of effective and applicable learning models that can improve the quality of mathematics education in Indonesia. In addition, this study is expected to provide practical recommendations for educators in implementing innovative learning methods that are tailored to students' needs, in order to prepare a competent generation to face global challenges.

METHODS

This study utilised two types of instruments, namely primary instruments and supporting instruments. The primary instrument in this study was the research team itself, as the researchers played a direct role in the data collection process, particularly through interaction with the research subjects. The supporting instruments consisted of three parts, namely a mathematical literacy problem-solving test, interview guidelines, and a validation sheet. To analyse students' problem-solving strategies, the researchers used a coding scheme to classify the strategies employed by students when solving mathematical literacy problems. Each strategy was represented by a specific code to facilitate the analysis of students' written responses and interview data. The strategies identified in this study included guess and check (S1), drawing or diagram (S2), simplifying the problem (S3), making a table (S4), finding patterns (S5), mathematical modelling or equation (S6), and logical reasoning (S7), Working Backward (S8). These codes were used to categorise the strategies applied by students in solving the given problems. In addition, students' creativity in problem solving was analysed based on three indicators of mathematical creativity, namely fluency (F1), flexibility (F2), and novelty (N). Fluency refers to the ability to generate more than one correct answer,

flexibility refers to the ability to apply different strategies in solving a problem, and novelty refers to the ability to produce original or uncommon ideas in problem solving.

The problem-solving test consists of two essay questions designed to measure students' ability to solve mathematical literacy problems. The interview guidelines are used as a guide for researchers so that the interview process runs in a focused manner and in accordance with the research objectives. Meanwhile, the validation sheet is used to ensure that the test questions and interview questions are in accordance with the indicators to be measured and are suitable for use in the research.

This research process consists of three main stages, namely the preparation stage, the implementation stage, and the data analysis stage. In the preparation stage, researchers carried out several steps, including preparing all research administrative requirements, compiling research instrument designs, and conducting expert validation of the instruments that had been compiled. Next, in the implementation stage, the researcher conducted a mathematical literacy problem-solving test to determine the research subjects. Based on the test results, the subjects were divided into three ability categories, namely low, medium, and high. After that, the researcher conducted a problem-solving ability test on the selected subjects and conducted interviews to verify the test results.

The final stage is data analysis, which begins with triangulation between test results and interviews to ensure data validity. If the data is deemed valid, the researcher proceeds to an in-depth analysis of the test results and interviews to identify students' strategies and creativity in solving mathematical literacy problems. The results of the analysis are then described in detail and compiled in a final research report.

RESULT AND DISCUSSION

This study examines students' strategies and creativity in solving mathematical literacy problems. The research subjects were determined by administering a mathematical literacy problem-solving test consisting of open-ended problems related to mathematical literacy contexts. The test had previously been validated by mathematics education experts to ensure its content validity. Based on the results of this test, students were classified into three levels of mathematical ability: high, medium, and low. From each category, two students were selected as research subjects, resulting in a total of six participants. In collecting the data, two stages of written tests and two stages of semi-structured interviews were conducted to verify and deepen the data obtained from students’ written responses.

Based on the results of the ability test, the selected research subjects are presented in Table 1.

Table 1. Research Subject

No	Initials	Category	Code
1	KMS	High	KMS-KT
2	I	High	I-KT
3	R	Intermediate	R-KS
4	SR	Intermediate	SR-KS
5	NAY	Low	NAY-KR
6	NS	Low	NS-KR

After determining the subjects, the researchers then verified the data by conducting two tests and two interviews with each subject. By examining the consistency of the test results, the final outcome of the study was a description of the students' strategies and creativity in solving mathematical literacy problems.

The results of the study show that most students have different strategies and creativity in solving problems. According to (Aydogdu, 2014), there are many factors that influence problem solving, but one of the most important of these factors is choosing and using the right strategy. Additionally, (Suwanto, Aisyah & Santoso, 2019) adds that one of the factors contributing to students' low performance in problem solving is the selection of inappropriate strategies. Apart from choosing the right strategy, success in solving a problem is also greatly influenced by the creativity possessed by students. Therefore, creativity plays an important role in problem solving. The following is a discussion of the description of student strategies and creativity in the high, medium and low categories.

1. Description of High-Achieving Students' Strategies and Creativity in Solving Mathematical Literacy Problems

Based on test data and interviews, students in the high category, namely KMS-KT and I-KT, demonstrated an excellent understanding of the problems. They were able to identify relevant information and explain the steps to solve the problems accurately and quickly. In addition, these students showed the ability to use appropriate strategies and generate ideas independently when solving the given problems.

Subject KMS-KT

Subject KMS-KT, in working on question 1, successfully met all three indicators of creativity. The student's written answers for questions 1 and 2 can be seen in Figure 1. These findings indicate that high-achieving students tend to apply more varied strategies and demonstrate stronger creative thinking when solving mathematical literacy problems. In addition, they were able to explain the reasoning behind the strategies they selected. This

shows that students with high mathematical ability are generally more flexible in exploring alternative solutions.

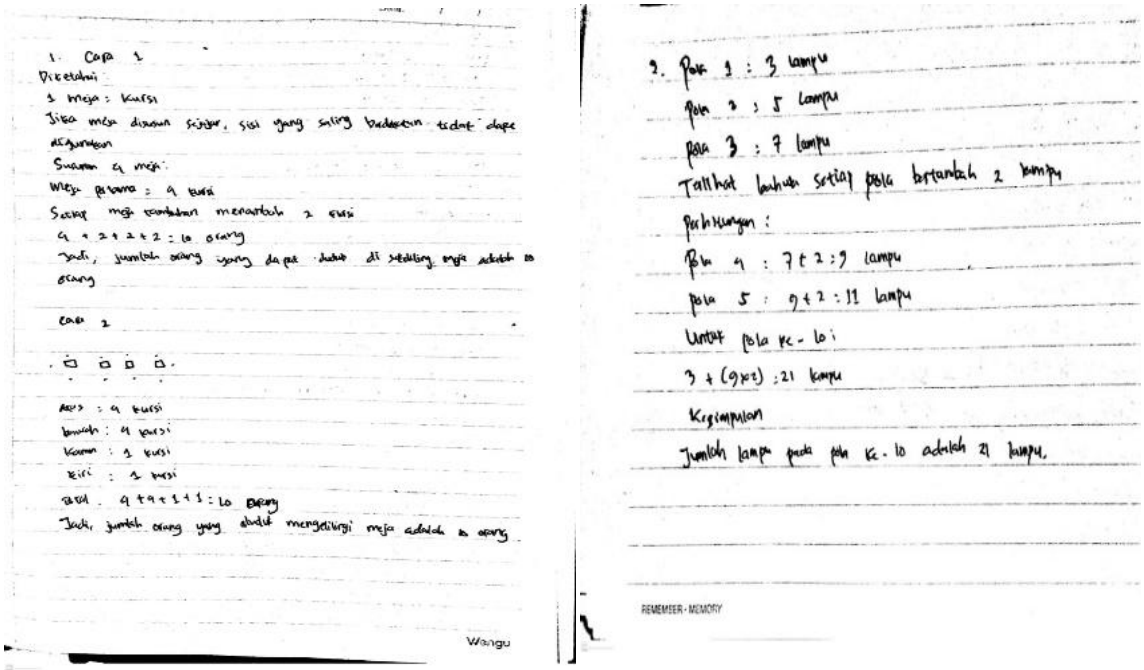

Figure 1. KMS-KT's Answers to Questions 1 and 2

In question number 1, subject KMS-KT successfully fulfilled all three indicators of creativity, namely fluency, flexibility, and novelty. The fluency indicator was demonstrated when the subject was able to produce two correct answers to the problem. This shows that the subject was able to explore more than one possible solution when solving the problem. In addition, the flexibility indicator was also fulfilled because the subject applied two different problem-solving strategies. The first strategy used was logical reasoning (S7), where the subject analysed the relationships between the given elements in the problem and logically determined the possible solutions. The second strategy was drawing (S2), which helped the subject visualise the structure of the problem more clearly. The use of these two strategies indicates that the subject was able to approach the problem from different perspectives.

Furthermore, the novelty indicator was also fulfilled by the subject. During the interview, the subject explained that the strategy used to solve the problem was based on their own idea and had not been previously taught directly by the teacher. This indicates that the subject was able to generate an original approach in solving the problem. The presence of originality in the strategy selection reflects the creative thinking ability of the subject when dealing with mathematical problems.

For question number 2, subject KMS-KT demonstrated the fluency indicator by successfully determining the correct answer using an effective strategy. In this case, the subject used the finding patterns strategy (S5). The subject carefully observed the numbers presented in the problem and identified a pattern that could be used to determine the final answer. The ability to recognise patterns is an important component in mathematical problem solving because it allows students to generalise relationships and simplify the solution process. Through this strategy, the subject was able to reach the correct conclusion efficiently. The subject also confirmed that the idea used to identify the pattern came from their own thinking process.

The interview results further strengthened the findings obtained from the written test. The interview excerpt is presented as follows:

P : How did you understand the given problem?

S (KMS-KT) : I first read the problem, then I looked at what information was given and what was being asked.

P : How did you solve problem number 1?

S (KMS-KT) : At first, I tried to calculate it. After that, I drew a diagram to make it easier to see the arrangement.

P : How did you find the answer to problem number 2?

S (KMS-KT) : I observed the numbers first and noticed a pattern, so I used that to determine the answer.

Based on the interview results, it can be seen that the subject first attempted to understand the problem by reading it carefully and identifying the known and required information. After that, the subject applied appropriate strategies such as calculation, drawing, and pattern recognition to solve the problem. These findings indicate that subject KMS-KT was able to combine analytical thinking and creativity when solving mathematical problems.

Subject I-KT

Subject I-KT also demonstrated a high level of understanding and accuracy in solving the given problems. Similar to subject KMS-KT, this subject was able to analyse the problem and determine appropriate strategies to reach the correct answers. The student's written answers for questions 1 and 2 can be seen in Figure 2. These findings indicate that high-achieving students tend to apply more varied strategies and demonstrate stronger creative thinking when solving mathematical literacy problems. In addition, they were able to explain the reasoning behind the strategies they selected clearly and systematically. This condition

shows that students with high mathematical ability are generally more flexible in exploring alternative solutions and applying appropriate strategies to solve mathematical literacy problems.

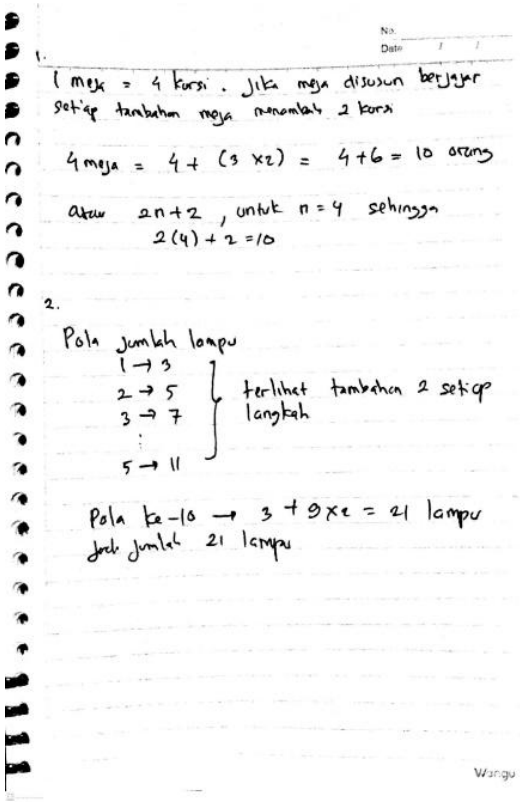

Figure 2. I-KT's Answers to Questions 1 and 2

In question number 1, subject I-KT fulfilled the fluency indicator by successfully finding two correct answers to the problem. The ability to generate more than one correct answer indicates that the subject was able to explore various possible solutions when dealing with the problem. In addition, the subject also fulfilled the novelty indicator because the strategy used in solving the problem was recognised as the result of the subject's own thinking process. The subject applied logical reasoning (S7) to analyse the relationships between the elements in the problem and determine the appropriate solution. This indicates that the subject was able to independently construct a reasoning process to reach the correct answer.

For question number 2, subject I-KT demonstrated both the fluency and flexibility indicators. The subject was able to determine the correct answer and also applied two different strategies to solve the problem. The first strategy used was finding patterns (S5), where the subject observed the pattern in the numbers presented in the problem. After identifying the pattern, the subject then used the making a table strategy (S4) to organise the

information systematically and make the calculation process easier. The use of more than one strategy indicates that the subject was able to approach the problem from different perspectives and select strategies that supported the solution process.

The interview results further confirmed the findings obtained from the written answers. The interview excerpt is presented as follows:

P : How did you understand the given problem?

S (I-KT) : I read the problem several times to understand what was being asked.

P : How did you solve problem number 1?

S (I-KT) : I tried to think of my own way to solve it until I got the answer.

P : How did you find the answer to problem number 2?

S (I-KT) : I first looked at the pattern, then I made a table to make it easier to calculate.

Based on the interview results, it can be concluded that subject I-KT used independent reasoning when solving the problems. The subject first attempted to understand the problem by reading it carefully, then analysed possible solution strategies through logical thinking and pattern recognition. The use of tables also helped the subject organise information systematically and simplify the solution process. These findings indicate that subject I-KT demonstrated creative thinking in problem solving by applying various strategies and generating ideas independently.

This fact shows that high-category subjects strive to use their creativity in problem solving. This is in line with the view of Richardo and Saputro (2014), which states that creativity is evident when students are able to see various possibilities and find new strategies. This finding is also supported by international research conducted by Siswono (2011), which found that level 3 (creative) students fulfil two components, such as flexibility and fluency, or novelty and fluency.

Another relevant study by Darmayanti and Sumardi (2018) also confirmed that students with high and moderate mathematical abilities can achieve fluency (giving more than one answer) and flexibility (explaining the process with appropriate reasoning). Furthermore, the findings of Novita and Putra (2016) support that the use of mathematical problem-solving questions, such as PISA questions, can stimulate students' creativity, as evidenced by the strategies and explanations they provide.

2. Description of Strategy and Creativity of Intermediate Level Students in Solving Mathematical Literacy Problems

Data analysis of intermediate-level students, namely subjects R-KS and SR-KS, shows that both students demonstrated a good understanding of the given problems.

Compared to students in the high category, these subjects were also able to identify relevant information and apply appropriate strategies in solving the problems, although the diversity of strategies and the depth of creative exploration were relatively more limited. The analysis of students' written answers and interview results indicates that moderate-category students were still able to demonstrate certain components of creativity in mathematical problem solving.

Subject R-KS

Subject R-KS demonstrated a good understanding of the problem. The subject was able to identify the information given and the information asked in question number 1 before attempting to determine the solution. The student's written answers for questions 1 and 2 can be seen in Figure 3.

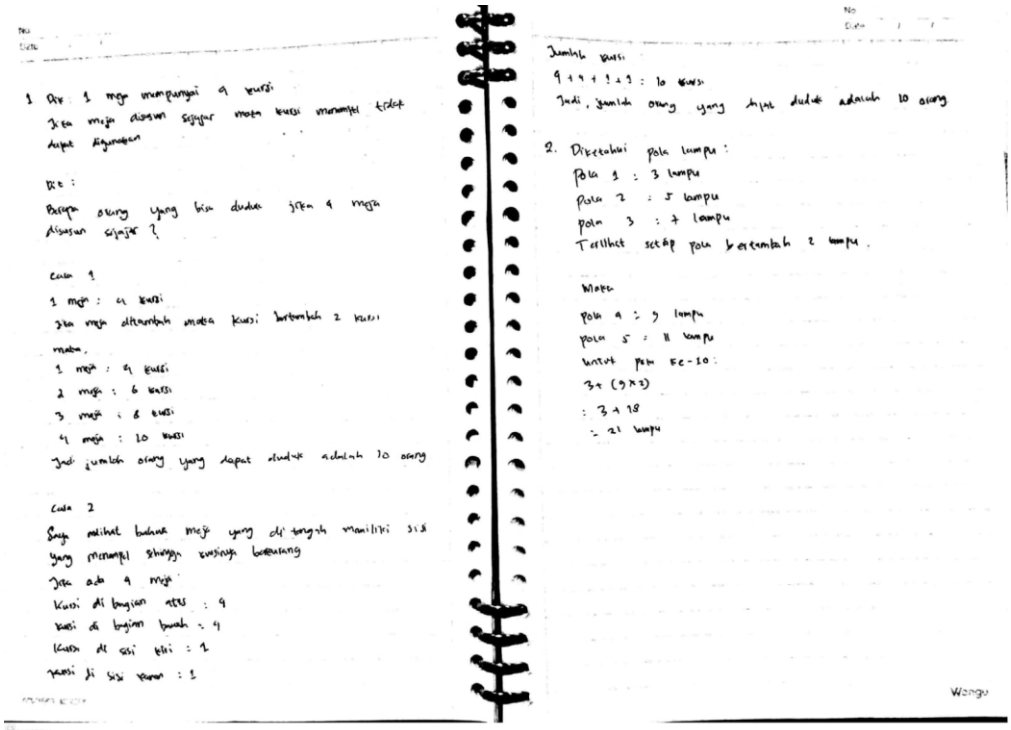

Figure 3. R-KS's Answers to Questions 1 and 2

In question number 1, subject R-KS successfully completed the problem using an effective strategy and correct reasoning. The subject was able to determine two correct answers to the problem, indicating that the fluency component of creativity was fulfilled. The ability to generate more than one correct answer shows that the subject was capable of exploring more than one possible solution to the given problem.

In addition to fluency, subject R-KS also demonstrated the novelty component. The subject explained that the method used to solve the problem was a new approach developed

through their own thinking process. The strategy applied in solving the problem was logical reasoning (S7), where the subject analysed the relationships between the elements in the problem and used reasoning to determine possible answers.

For question number 2, subject R-KS again demonstrated a good understanding of the problem. The subject fulfilled the fluency indicator by successfully determining the correct answer using one effective strategy. In this case, the subject used the finding patterns strategy (S5). The subject carefully observed the sequence of numbers presented in the problem and attempted to identify a pattern that could be used to determine the correct solution. Through this approach, the subject was able to reach the final answer accurately.

The interview results further confirmed the strategies used by the subject during the problem-solving process. The interview excerpt is presented as follows:

P : How did you understand the given problem?
S (R-KS) : I first read the problem, then I identified what information was given and what needed to be found.
P : How did you solve problem number 1?
S (R-KS) : I tried to think through the steps, then I calculated until I found possible answers.
P : How did you find the answer to problem number 2?
S (R-KS) : I first looked at the sequence of numbers, then I tried to find the pattern.

Based on the interview results, it can be seen that subject R-KS attempted to understand the problem by first reading the question and identifying the known and required information. The subject then applied logical reasoning and pattern recognition to determine the final answer. These findings indicate that the subject was able to apply appropriate strategies in solving mathematical problems, although the number of strategies used was still relatively limited.

Subject SR-KS

Subject SR-KS also demonstrated a strong understanding of the given problems. The subject was able to explain clearly what information was known and what was asked in the problem. The student's written answers for questions 1 and 2 can be seen in Figure 4.

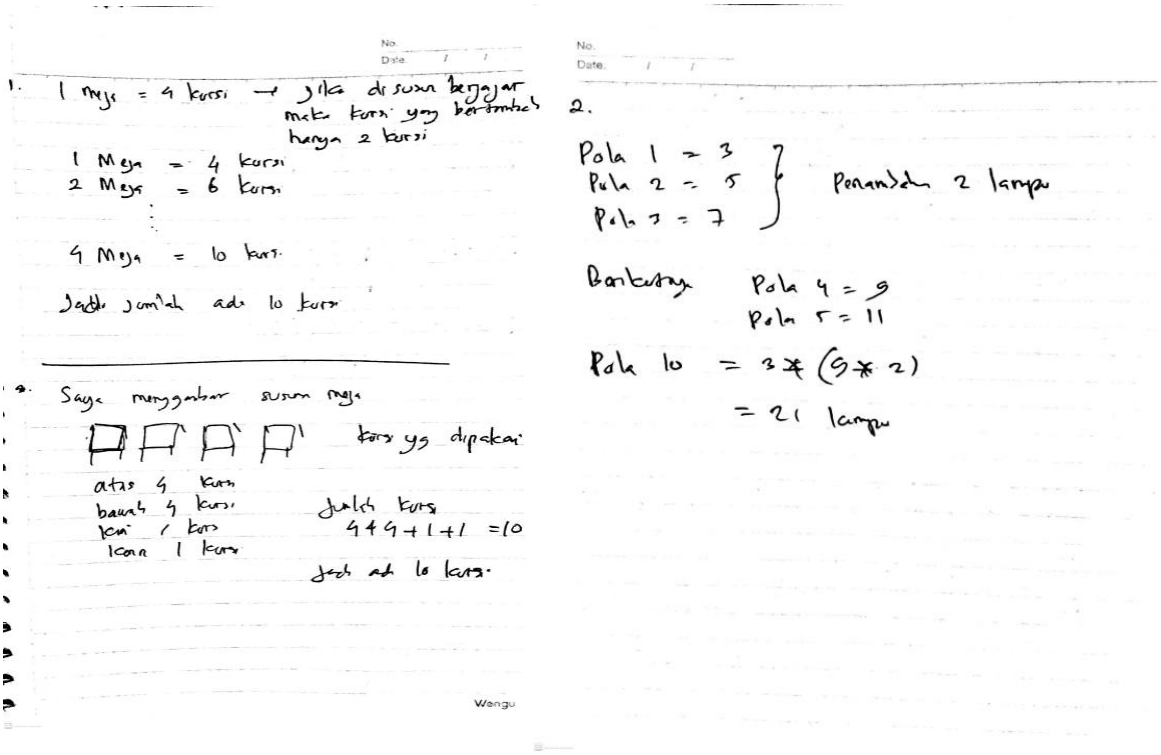

Figure 4. SR-KS's Answers to Questions 1 and 2

During the interview, subject SR-KS demonstrated an accurate and relatively fast work process when explaining the steps used to solve the problem. In question number 1, the subject demonstrated the flexibility component of creativity by using two different strategies to determine the solution. The strategies used were logical reasoning (S7) and drawing (S2)**.**

The use of logical reasoning allowed the subject to analyse the relationships within the problem and determine possible answers through reasoning. Meanwhile, the drawing strategy helped the subject visualise the structure of the problem more clearly. The use of two different strategies indicates that the subject was able to approach the problem from different perspectives.

In addition, subject SR-KS also demonstrated the novelty component, because the strategy used to solve the problem was acknowledged as a new method developed through the subject's own thinking. Therefore, the indicators fulfilled in question number 1 were flexibility and novelty**.**

For question number 2, subject SR-KS again demonstrated a good understanding of the problem and was able to determine the correct answer accurately. In this case, the subject fulfilled the fluency indicator by successfully determining one correct answer using an effective strategy. The strategy used was finding patterns (S5)**,** where the subject analysed

the sequence of numbers presented in the problem and identified the pattern that could lead to the correct solution. The subject also explained that the strategy used to determine the pattern was the result of their own reasoning process.

The interview results supporting these findings are presented as follows:

P : How did you understand the given problem?

S (SR-KS) : I read the problem and first identified what information was given and what was being asked.

P : How did you solve problem number 1?

S (SR-KS) : At first, I tried to calculate it. Then, I also drew a diagram to make it easier to see the arrangement.

P : How did you find the answer to problem number 2?

S (SR-KS) : I looked at the numbers, then I followed the pattern to determine the answer.

Based on the interview results, it can be concluded that subject SR-KS used a combination of reasoning and visual representation to solve the problem. The subject also demonstrated the ability to recognise patterns and apply them to determine the correct answer. These findings indicate that the subject was able to apply different strategies when solving mathematical problems, although the exploration of strategies was still not as extensive as that shown by students in the high category.

These facts indicate that subjects in the moderate category attempt to solve problems according to their creativity. This is in line with the opinion of Richardo and Saputro (2014), which states that creativity is evident when students are able to see various possibilities, make assumptions, and find new strategies in solving problems.

These findings are also consistent with an international study conducted by Siswono (2011), which showed that level 3 students fulfil two components of creativity, namely flexibility and fluency, or novelty and fluency. Another relevant study by Darmayanti and Sumardi (2018) concluded that the fluency aspect can be achieved by students with high and moderate mathematical abilities, who are able to provide more than one correct answer. The flexibility aspect can also be achieved by this group of students, who are able to explain the problem-solving process and provide appropriate reasoning for their answers.

3. Description of Low-Level Students' Strategies and Creativity in Solving Mathematical Literacy Problems

Based on the test results and interviews, students in the low category, namely subjects NAY-KR and NS-KR, showed significant challenges in creative problem solving. Compared to students in the high and moderate categories, these subjects experienced greater difficulty

in understanding the problem, selecting appropriate strategies, and generating correct solutions. The analysis of students' written answers and interview results indicates that students in this category were generally unable to demonstrate the indicators of mathematical creativity, namely fluency, flexibility, and novelty.

Subject NAY-KR

Subject NAY-KR demonstrated a lack of understanding of the problem presented in question number 1. The subject appeared to have difficulty identifying the important information contained in the problem, which led to an incorrect final answer. The student's written answers for questions 1 and 2 can be seen in Figure 5. These findings indicate that students in the moderate category were able to demonstrate creative thinking through the use of appropriate strategies and logical reasoning. Although the variety of strategies used was still limited compared to high-achieving students, they were able to understand the problems and determine correct solutions. The use of pattern recognition, drawing, and logical reasoning also reflects their ability to connect mathematical ideas when solving literacy problems.

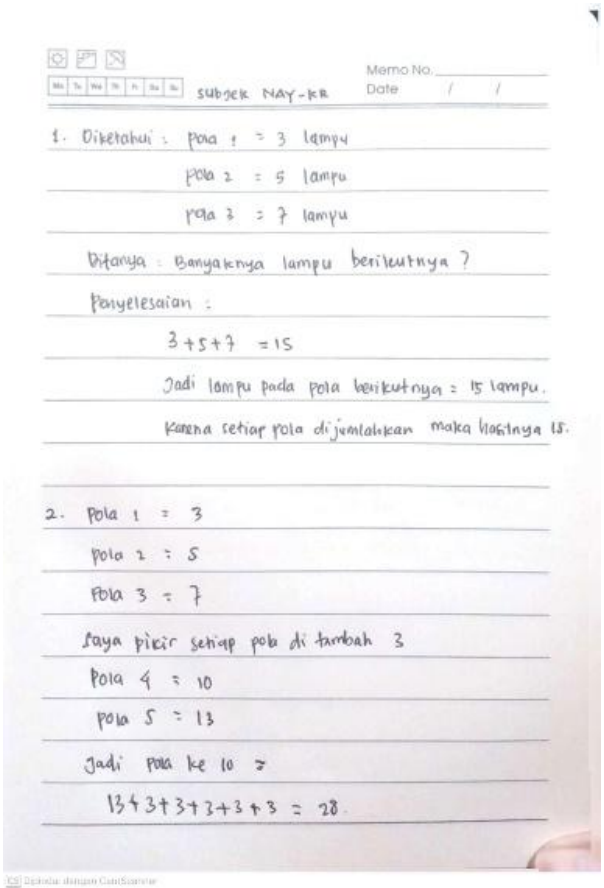

Figure 5. NAY-KR's Answers to Questions 1 and 2

In question number 1, subject NAY-KR was unable to determine the correct solution to the problem. As a result, the subject failed to demonstrate the fluency indicator, because the subject was not able to produce even one correct answer. In addition, the subject also did not demonstrate the flexibility indicator, since only one strategy was used in attempting to solve the problem. The strategy applied by the subject was logical reasoning (S7); however, the reasoning process used was not sufficient to lead to the correct solution.

Furthermore, the subject also failed to demonstrate the novelty indicator, because the solution process did not involve any new or original ideas. Instead, the subject relied on a limited reasoning process that did not effectively address the requirements of the problem. These findings indicate that the subject experienced significant difficulty in developing creative strategies to solve the problem.

A similar pattern appeared in question number 2. Subject NAY-KR again demonstrated difficulty in understanding the problem, which resulted in an incorrect final answer. Although the subject attempted to explain what was understood from the question, the explanation was still incomplete and did not lead to the correct solution. As a result, the subject did not meet the indicators of fluency, flexibility, or novelty. The strategy applied in this question was again logical reasoning (S7), but the reasoning process used was not appropriate for solving the problem.

The interview results further confirmed the difficulties experienced by the subject in understanding and solving the given problems. The interview excerpt is presented as follows:

P : How did you understand the given problem?
S (NAY-KR) : I read the problem, but I was still not sure what it meant.
P : How did you solve problem number 1?
S (NAY-KR) : I just tried to calculate based on what I understood, but I was not very sure about my answer.
P : How did you find the answer to problem number 2?
S (NAY-KR): I tried to calculate using the numbers in the problem, but I was a bit confused about how to do it.

Based on the interview results, it can be seen that subject NAY-KR attempted to solve the problem based on partial understanding of the information given in the question. However, the subject expressed uncertainty about the meaning of the problem and the steps needed to determine the correct solution. This indicates that the subject experienced difficulty in interpreting the problem and selecting appropriate strategies for solving it.

Subject NS-KR

Subject NS-KR also demonstrated difficulty in understanding and solving the given problems. Similar to subject NAY-KR, this subject experienced challenges in determining

appropriate strategies and producing correct solutions. The student's written answers for questions 1 and 2 can be seen in Figure 6.

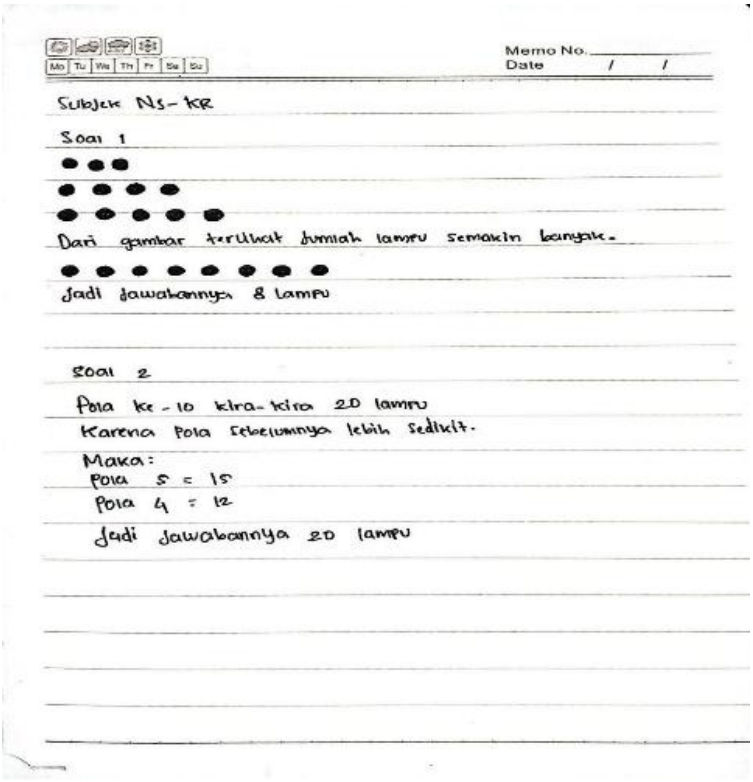

Figure 6. NS-KR's Answers to Questions 1 and 2

In question number 1, subject NS-KR showed limited understanding of the problem, which resulted in an incorrect solution. The subject attempted to approach the problem using the drawing strategy (S2) by representing the structure of the problem visually. However, the diagram produced did not accurately represent the relationships between the elements in the problem, which prevented the subject from reaching the correct conclusion.

As a result, the subject failed to demonstrate the indicators of fluency, flexibility, and novelty. The subject was not able to produce a correct answer, did not use more than one strategy, and did not demonstrate any new or original approach to solving the problem.

For question number 2, subject NS-KR again demonstrated weak understanding of the problem. The subject attempted to determine the answer by applying the working backward strategy (S8). However, the strategy was not implemented effectively, and the subject was unable to determine the correct solution. In addition, the subject did not attempt to use alternative strategies that might have helped in solving the problem.

The interview results confirmed the difficulties experienced by the subject in understanding the problem and determining appropriate strategies. The interview excerpt is presented as follows:

P : How did you understand the given problem?

S (NS-KR) : I read the problem, but I found it a bit difficult to understand what needed to be found.

P : How did you solve problem number 1?

S (NS-KR) : I tried drawing it first so I could see the arrangement more clearly.

P : How did you find the answer to problem number 2?

S (NS-KR) : I tried starting from the end, but I was still confused about how to determine the answer.

Based on the interview results, it can be concluded that subject NS-KR attempted to apply certain strategies, such as drawing and working backward, to solve the problem. However, the subject experienced difficulty in understanding the problem structure and applying the strategies effectively. As a result, the solution process did not lead to the correct answer.

The low level of creative thinking demonstrated by students in this category can be explained by their limited understanding of the problem context and difficulty in selecting appropriate problem-solving strategies. Based on the interview results, students in the low-ability category tended to focus only on performing direct calculations without fully interpreting the information presented in the problem. This situation made it difficult for them to explore alternative strategies or generate different possible answers. Consequently, the indicators of creativity such as fluency, flexibility, and novelty were not achieved. The difficulties experienced by students in the low category are also supported by Wulandari et al. (2024), who reported that some students are able to complete problem-solving tasks but still struggle to develop alternative or original strategies. Students at this level tend to rely on a single approach and have limited ability to explore different solution pathways.

The difficulties experienced by students in this category are closely related to their inability to understand the problem correctly, which subsequently affects other stages of problem solving. This finding is supported by Fernanda et al. (2024), who stated that errors in interpreting problems can influence the process of mathematizing, selecting strategies, and executing solutions. When students fail to understand the problem, the strategies they choose tend to be inappropriate, leading to incorrect or incomplete solutions. Furthermore, although some students are able to produce correct answers, their reasoning and arguments

are often not based on proper mathematical concepts, indicating that their mathematical literacy process is still not fully developed. This indicates that understanding the problem is a fundamental aspect that determines students' success in solving mathematical literacy problems.

Another factor that may influence this condition is students' limited experience in solving non-routine or mathematical literacy problems. When students are rarely exposed to open-ended or contextual problems, they tend to rely on single procedures and become less confident in exploring different solution strategies. This finding is consistent with Siswono (2011), who stated that students at the lowest level of creative thinking generally experience difficulties in generating ideas and applying various strategies when solving mathematical problems. Similarly, Darmayanti and Sumardi (2018) reported that students with low mathematical ability often struggle to produce more than one correct answer and to apply different approaches, which affects the development of fluency and flexibility in mathematical creativity. This finding indicates that students with higher abilities tend to use multiple strategies and produce more varied solutions, while students with lower abilities rely on limited approaches. This is in line with the findings of Utari, Dwijanto, and Dewi (2023), which show that the use of various problem-solving strategies can enhance students' mathematical creative thinking, particularly in terms of fluency, flexibility, and originality. Furthermore, previous research also shows that students are able to generate multiple solutions and apply different approaches, indicating fluency and flexibility; however, the level of originality may vary among students, as some tend to rely on conventional strategies while others are able to develop more unique approaches. This is supported by the findings of Rusmana and Shodikin (2024), which highlight differences in students' originality despite demonstrating fluency and flexibility in problem solving. In addition, previous research also shows that although students are able to generate initial ideas, their ability to develop and elaborate these ideas is still limited, resulting in incomplete or underdeveloped responses. This is consistent with the findings of Rahmania and Shodikin (2024), which highlight the need for more contextual and interactive learning approaches to support the development of students' creative thinking.

The findings of this study provide several pedagogical implications for mathematics teaching and learning. The differences in creative thinking performance among students with high, medium, and low abilities indicate that students require learning experiences that encourage them to explore various problem-solving strategies. Mathematics instruction should not focus solely on obtaining the correct answer, but also on encouraging students to

explain their reasoning and consider alternative strategies. The use of mathematical literacy or contextual problems can help students develop the ability to analyse situations, identify relevant information, and construct appropriate solution strategies.

Furthermore, the results show that students with higher abilities tend to use multiple strategies such as logical reasoning, pattern finding, drawing, and table construction, which contribute to the development of fluency, flexibility, and novelty in problem solving. Therefore, teachers are encouraged to design learning activities that allow students to explore different solution strategies and discuss them collaboratively in the classroom. Activities such as open-ended problems, group discussions, and reflective questioning can stimulate students to think more creatively and develop their confidence in generating original ideas.

In addition, special attention should be given to students with lower mathematical abilities. The findings indicate that these students often experience difficulties in understanding the problem context and selecting appropriate strategies, which limits their ability to demonstrate creative thinking. To address this issue, teachers can provide scaffolding through guided questions, step-by-step exploration of the problem context, and modelling of different problem-solving approaches. Through continuous exposure to non-routine problems and opportunities to reflect on their solution processes, students can gradually improve their ability to apply various strategies and develop creative thinking skills in mathematics.

CONCLUSION

The results of this study describe the problem-solving strategies used by students and the level of mathematical creativity demonstrated in solving mathematical literacy problems. The strategies identified in this study include drawing or diagram (S2), making a table (S4), finding patterns (S5), logical reasoning (S7), and working backward (S8). These strategies were used differently by students depending on their level of mathematical ability.

Students in the high-ability category demonstrated a strong understanding of the problems and were able to apply more than one strategy appropriately. They showed three indicators of mathematical creativity: fluency, flexibility, and novelty. These students were able to produce more than one correct answer, apply different strategies such as logical reasoning and drawing, and explain that the strategies used were the result of their own ideas.

Students in the moderate category also demonstrated a good understanding of the problems, although the variety of strategies used was more limited. Most of these students were able to meet one or two indicators of creativity, particularly fluency and novelty. They

were able to find correct answers and identify patterns in the problem, but the diversity of strategies was not as extensive as that of high-ability students.

Meanwhile, students in the low-ability category experienced difficulties in understanding the problems and selecting appropriate strategies. As a result, they generally used only one strategy and were unable to produce correct or varied solutions. Consequently, these students did not meet the indicators of creativity, including fluency, flexibility, and novelty.

Overall, the findings show that students with different levels of mathematical ability demonstrate different patterns in using problem-solving strategies and expressing mathematical creativity when solving mathematical literacy problems. These findings suggest that mathematics learning should provide opportunities for students to explore various solution strategies and engage with non-routine problems so that their creative thinking can develop more effectively.

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