Analysis of Students' Mathematical Problem-Solving Ability on Fraction Material

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Abstrak

Kemampuan dalam memecahkan masalah matematika merupakan aspek krusial yang perlu dikembangkan oleh siswa agar mampu mengaplikasikan konsep-konsep matematika dalam situasi kehidupan nyata, bukan hanya sebatas memahami teori. Penelitian ini bertujuan untuk mengkaji kemampuan siswa kelas V di SDN 1 Dawuan, Kabupaten Cirebon, dalam memecahkan permasalahan matematika pada topik pecahan, dengan fokus pada aspek pemahaman masalah, perencanaan solusi, dan evaluasi hasil penyelesaian. Pendekatan deskriptif kualitatif digunakan dalam penelitian ini, dengan enam siswa yang dikategorikan ke dalam tiga level kemampuan tinggi, sedang, dan rendah. Instrumen yang digunakan yaitu tes uraian berjumlah sembilan soal terkait pemecahan masalah dalam materi pecahan. Analisis data dalam penelitian ini mencakup tahapan teknik reduksi data, penyajian data, serta penarikan kesimpulan. Temuan penelitian menunjukkan bahwa dari enam peserta didik, sebanyak dua siswa (33%) tergolong dalam kategori kemampuan pemecahan masalah tinggi, empat siswa (67%) berada pada kategori sedang, dan tidak satu pun siswa yang termasuk dalam kategori rendah (0%). Meskipun sebagian besar siswa menunjukkan kemampuan yang baik, banyak yang masih mendominasi kategori sedang. Beberapa siswa tidak menuliskan informasi dan pertanyaan secara lengkap serta kesulitan dalam memilih operasi yang tepat. Selain itu, baik siswa kategori tinggi maupun sedang sering tidak memeriksa kembali jawaban mereka. Temuan ini menekankan pentingnya melatih siswa untuk menyelesaikan masalah dengan teliti dan memeriksa penyelesaian akhir.
Kata Kunci: Analisis; Kemampuan pemecahan masalah matematika; Pecahan

Abstract

The ability to solve mathematical problems is a crucial aspect that students need to develop so they can apply mathematical concepts in real-life situations, not just understand the theory. This study aims to assess the ability of fifth-grade students at SDN 1 Dawuan, Cirebon Regency, in solving mathematical problems on the topic of fractions, with a focus on the aspects of problem understanding, solution planning, and evaluation of the results of the solution. A qualitative descriptive approach was used in this study, with six students categorized into three levels of high, medium, and low ability. The instrument used was a descriptive test consisting of nine questions related to problem solving in the material of fractions. Data analysis in this study included the stages of data reduction techniques, data presentation, and drawing conclusions. The research findings showed that of the six students, as many as two students (33%) were classified as having high problem-solving ability, four students (67%) were in the medium category, and none of the students were included in the low category (0%). Although most students showed good abilities, many still dominated the medium category. Some students did not write complete information and questions, and had difficulty choosing the correct operation. In addition, both high and medium category students often did not recheck their answers. These findings emphasize the importance of training students to solve problems carefully and check their final solutions.
Keywords: Analysis; Mathematical Problem-Solving Skills; Fractions

I. INTRODUCTION

As a basic discipline, mathematics is included in the curriculum from primary school through to university (Ariyana & Suastika, 2022). Its importance lies not only in its function as a tool for calculation but also in its ability to develop students' logical, critical, and analytical thinking skills (Duha, 2024).

In general, mathematics encompasses three main aspects: the product aspect, which includes concepts and principles; the process aspect, which involves methods for acquiring knowledge; and the attitude aspect, which relates to scientific attitudes and the underlying values (Afsari et al., 2021). One of the key competencies that mathematics education should cultivate is the capability to resolve mathematical problems (Saputra et al., 2023). This ability serves as a bridge for applying mathematics in various contexts, including academic fields, other sciences, and everyday life (Nasution et al., 2023).

Nevertheless, field observations show that many students encounter difficulties in solving mathematical problems, particularly those involving fractions (Prihantini et al., 2021; Hidayatullah, Sari, & Lutfianto, 2024). Fractions are considered one of the more complex topics for students, as they require an understanding of number concepts, relationships between numbers, and precise calculation skills (Astuti et al., 2022).

Previous research has revealed that students' difficulties in understanding the concept of fractions result in their low ability to resolve mathematical problems (Sari et al., 2024). This condition highlights a gap between the curriculum's expectations, which emphasize higher-order thinking skills, and the reality observed in the field (Riyanto et al., 2024). This situation underlines the importance of conducting research that investigates not only students' performance but also the cognitive processes they go through during problem-solving, in order to develop more effective teaching strategies (Helmi & Arsid, 2021).

Lathifah et al. (2021) identify five primary factors that impact students' ability to handle mathematical problem solving: comprehension of the problem, choice of solution strategies, capacity for logical reasoning, confidence in tackling problems, and proficiency in processing data.

In line with this, Polya (as cited in August & Ramlah, 2021) emphasized that solving mathematical problems typically requires four essential stages: comprehending problem, devising an approach, executing strategy, and evaluating the outcome. This structured process helps students think critically and solve problems effectively.

Various studies have discussed students' mathematical problem-solving abilities. Rahayu & Aini (2021) in their research indicated that students' mathematical problem-solving ability show that several problem-solving indicators tested on students have not been met. This indicates that students are classified as having limited mathematical problem-solving ability. However, the Damianti & Afriansyah (2022) study reveals that students demonstrate strong proficiency in solving mathematical problems.

These findings show a diversity of outcomes but tend to focus on achievement levels only. Many studies

have not explored in depth the thinking process at each step of problem-solving, especially in the context of fractions. Hence, further investigation is needed to enrich the current body of knowledge regarding students' internal strategies and problem-solving behaviors.

However, most of the previous studies have primarily focused on the final outcomes, such as students' scores or achievement levels, without delving into the students' thinking processes at each stage of problem-solving (Sriwahyuni & Maryati, 2022; Talia, Afriansyah, & Sumartini, 2024). Therefore, further research is needed that not only quantitatively measures students' abilities but also qualitatively analyzes how students understand, plan, and solve problems, as well as how well they can reflect on their work.

The newness of this research lies in its use of Polya's problem-solving stages to qualitatively examine how students with different ability levels (high, medium, and low) approach each stage of solving fraction problems, providing deeper insight into the learning process.

In response to this gap, the current study seeks to examine the mathematical problem-solving abilites belonging to Grade 5 students at SDN 1 Dawuan, Cirebon Regency, and focus on the topic of fractions. This research follows Polya's problem-solving steps and categorizes students into three ability levels: high, medium, and low. This strategy aims to better reveal both the capabilities and limitations of students when tackling fraction problems.

This research intends to examine problem-solving skills of grade 5 students at mathematics, specifically concerning fractions, concentrating on three core aspects: problem comprehension, solution planning, and result evaluation. Moreover, this research seeks to determine the factors that affect students' success or failure at each stage of the problem-solving process.

II. Method

A descriptive qualitative design was applied in conducting this study. This method aims to depict actual conditions or phenomena as they are, without manipulating the variables under investigation (Ahmad & Muslimah, 2021). This method focuses on collection of qualitative data and its presentation in descriptive form, thereby providing a clear depiction of social phenomena being investigated (Sugiyono, 2022).

This research was carried out in November 2025 to assess fifth-grade students' abilities in solving mathematical problems specifically concerning about fractions at SDN 1 Dawuan, Cirebon Regency. Participating in this study were six fifth-grade students, categorized as two high achievers, two with average skills, and two with lower abilities. The instrument employed was a written test comprising nine questions focused on mathematical problem-solving in fractions.

Data collection was conducted by administering individual questions to each subject. Subsequently, the test results from each subject were analyzed by the researcher and categorized in three ability

levels: high, medium, and low. Data in this research were examined using three phases: reducing the data, displaying data, and drawing conclusions, following the qualitative analysis framework proposed by Miles and Huberman (as cited in Galuh et al., 2023).

Classification of students' skills in solving mathematical problems was determined according standards set by Utami & Hakim (2023), as depicted in the table below:

Table 1.
Mathematical Problem-Solving Ability Classification

Classification	Interval
High	$x > \bar{x} + s$
Medium	$\bar{x} - s \leq x \leq \bar{x} + s$
Low	$x < \bar{x} + s$

Description:

x: the score obtained by a student

$\bar{x}$: the average score obtained by the students

s: the standard deviation of the scores

III. RESULT AND DISCUSSION

The data below presents the outcomes of students' efforts in solving mathematical problems performance on fractions in elementary school:

Table 2.
Mathematical Problem Solving Ability Statistic

Descriptive Statistics	
Number of Student	6
Maximum Score	90
Minimum Score	27
Average	58.8
Standard Deviation	26.9

Referring to the table above, the students' mathematical problem-solving scores range between 27 and 90, with the average score achieved was 58.8, with a standard deviation of 26.9, highlighting the ability of SDN 1 Dawuan's fifth-grade students in solving problems are classified as high classification, suggesting that they are generally capable of solving word

problems involving fractions. To identify the levels of students' mathematical problem-solving abilitiesthe categorization is determined according to the following parameters:

Table 3.
Result of Mathematical Problem Solving Ability

Classification	Interval	Number of Students	Percentage
High	$x > 85.7$	2	33%
Medium	$32.0 \leq x \leq 85.7$	4	67%
Low	$x < 32.0$	0	0%
Total		6	100%

According to the table, two students fall in high category in terms from their mathematical problem-solving ability, representing 33% of the total, with interval scores greater than 85.7. There are 4 students in the medium category, accounting for 67%, with interval scores either greater than 32.0 or less than 85.7. Finally, no students fall into the low category, with 0% in this group and interval scores below 32.0. Therefore, the total number of students is 6, making up 100% of the group.

The primary instrument utilized in this research was a descriptive test aimed at measuring students' capabilities in tackling math problems, particularly related to fractions. The test comprised a total of nine open-ended questions intended to evaluate students' conceptual understanding, procedural skills, and reasoning in solving fractional problems.

Data collection was conducted by administering the test individually to each participant, allowing for an in-depth exploration of their problem-solving processes and strategies. The responses obtained from each student were carefully

examined and analyzed by the researchers. The analysis results categorized students' problem-solving proficiency in mathematics—high, medium, and low, determined by the degree of precision, thoroughness, and problem-solving approaches evident in their answers.

Presented below are the test items administered to the students, accompanied by selected examples of their responses:

Question number 1 is as follows:

"Sebuah tali panjangnya $\frac{7}{8}$ meter, kemudian tali itu akan dipotong menjadi 4 bagian sama panjang. Berapa panjang tiap potongan tali tersebut?"

Figure 1. One of the moderate category students' answers to question number 1.

Based on the picture above, students in the moderate category comprehend the issue presented in question number 1. Despite this, most students neglect to write down all the known and required elements. Similarly, in the planning stage, they usually attempt to solve the problem immediately without establishing a structured plan. Even so, during the implementation stage, students manage to arrive at the correct solution, suggesting they have a clear understanding of the first question. However, students tend to overlook the importance of identifying and recording all the provided and needed information when understanding the problem. Additionally, the students do not recheck their answers. As a result, the findings above show that moderate category students focus mainly on solving the

problem without applying the correct concept. It also indicates that in the process of solving, the students do not provide a written conclusion.

Figure 2. One of the high category students' answers to question number 1.

Furthermore, based on the picture above, high-category students understand the problem well, as evidenced by their complete writing of the known and asked information. In preparing the plan, there are no issues, demonstrating that high-category students possess good problem-solving ability and are able to develop appropriate solutions. Even though they omit drawing a conclusion at the end, the students exhibit sufficient comprehension of the problem and its application to everyday scenarios.

The conclusion from the answers given by high- and moderate-category students shows a similarity: none of them include a conclusion at the end of their answers.

Question number 2 is as follows:

"Sebuah papan kayu panjangnya $\frac{9}{10}$ meter. Setelah dipotong panjangnya berkurang $\frac{2}{5}$ meter. Berapa panjang sisa papan?"

Figure 3. One of the moderate category students' answers to question number 2.

Based on the picture above, moderate-category students understand the problem in question number 2; however, neither of them writes down the complete known and asked information. In preparing their plans, both students also focus directly on solving the problem without outlining a proper strategy. Nevertheless, in carrying out the plan, they can to solve the problem correctly, indicating that they understand the question number 2. However, they are not accustomed to fully analyzing the problem by documenting the complete known and asked information. In addition, the students do not recheck their answers, resulting in one of the answers not being expressed in its simplest fractional form. These results show that moderate-category students tend to focus solely on problem-solving without applying the appropriate concept. It also indicates that in their working and calculation processes, they fail to write a final conclusion.

Figure 4. One of the high category students' answers to question number 2.

Furthermore, based on the picture above, high-category students understand the problem well, as evidenced by their complete writing of the known and asked information. In preparing the plan, there are no issues. This demonstrates that high-category students possess strong problem-solving ability and are capable of producing good solutions. However, they do not

provide a conclusion in the last line of the problem-solving process. Nevertheless, the students have sufficiently understood the problem and are able to apply it to everyday life situations. In addition, they did not recheck their answers, leading to a mistake in simplifying the fraction to its simplest form.

In conclusion, for question number 2, students from both the moderate and high categories did not re-examine their answers.

Question number 3 is as follows:

"Pak Budi memiliki $\frac{5}{6}$ liter minyak goreng. Ia menggunakan $\frac{1}{3}$ liter untuk memasak. Berapa liter minyak goreng yang tersisa?"

Figure 5. One of the moderate category students' answers to question number 3.

Referring to the image above, students categorized at the moderate level demonstrate an understanding of the problem presented in question number 3. However, they often skip documenting the full details of the given and required information. In devising a plan, the student tends to jump straight into solving the problem without laying out a well-defined and organized strategy beforehand. Despite this, during the execution phase, the student manages to solve the problem accurately, indicating a sound comprehension of the question's intent.

Nevertheless, the student has yet to develop the habit of thoroughly analyzing the problem by documenting all relevant known and required information. Moreover, the student does not review or

verify the final answer, which results in one of the responses not being simplified to its lowest fractional form. This suggests a need for further emphasis on reflective practices and attention to mathematical conventions.

These results indicate that moderate-category students tend to focus solely on problem-solving without applying the appropriate concepts. It also shows that during the working and calculation process; students do not write final conclusions.

Figure 6. One of the high category students' answers to question number 3.

Furthermore, based on the picture above, high-category students understand the problem well, as evidenced by their complete writing of the known and asked information. In preparing the plan, there are no issues. This demonstrates that high-category students possess strong problem-solving ability and are capable of producing appropriate solutions. Although they do not include a concluding statement at end of the problem-solving process, the students still demonstrate an adequate understanding of the problem and are capable of applying it in real-life contexts.

The conclusion from the students' answers to question number 3 is that students in both the moderate and high categories did not recheck their answers.

Question number 4 is as follows:

"Dina memiliki $\frac{4}{7}$ kg tepung. Ia menggunakan $\frac{2}{5}$ dari jumlah tersebut untuk

membuat kue. Berapa kg tepung yang digunakan Dina?"

Figure 7. One of the moderate category students' answers to question number 4.

Referring to the image above, students in the moderate category demonstrate an understanding of question number 4, yet they do not fully record the given and required information. In preparing the plan, the two students also focus directly on solving the problem without outlining a proper strategy. However, when implementing the plan, their solution is incorrect. There are errors in both the calculation process and the final result, indicating that the students did not fully understand the problem.

Figure 8. One of the high category students' answers to question number 4.

The image above shows that high-ability students demonstrate a strong understanding of the problem, as seen in their complete identification of known and asked information. They encounter no issues during the planning stage. However, they often omit a concluding statement, which is important for summarizing their reasoning. One student, nonetheless, shows the ability to apply the problem to real-life situations, reflecting adequate comprehension.

Analysis of responses to question number 4 reveals that students in both the

moderate and high ability groups did not re-examine their answers. This indicates a lack of thoroughness in their problem-solving process, as some answers remained incomplete or unsimplified.

Question number 5 is as follows:

"Seekor kucing makan $\frac{2}{3}$ dari $\frac{1}{2}$ kg ikan. Berapa bagian ikan yang dimakan kucing?"
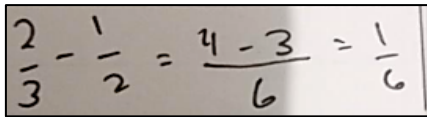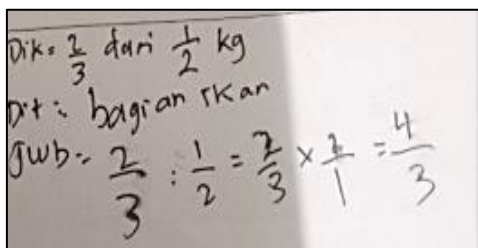

Figure 9. One of the moderate category students' answers to question number 5.

As shown in the image above, students in the moderate ability group comprehend the problem in question number 5, yet they do not fully record all the given and required information. In preparing the plan, the students focus directly on solving the problem without outlining a proper strategy. As a result, the implementation of the plan is incorrect. The problem should be divided, but instead, the students attempt to solve it by subtraction. There are errors in both the calculation process and the final result, indicating that the students are unable to solve the problem correctly.

Figure 10. One of the high category students' answers to question number 5.

Furthermore, based on the picture above, high-category students understand the problem well, as evidenced by their complete writing of the known and asked information. In preparing the plan, there

are no issues. This demonstrates that high-category students possess strong problem-solving ability and can come up with effective solutions. However, a final conclusion is not included in their solution. Nevertheless, the students have a sufficient understanding of the problem and are able to apply it to everyday life situations.

It can be concluded from the responses to question number 5 that students in both the moderate and high categories failed to include a concluding statement in their answers.

Question number 6 is as follows:

"Pada sebuah taman $\frac{3}{5}$ luasnya ditanami bunga, dan sisanya adalahditanami rumput. Berapa bagian tanaman yang dimakan rumput?"
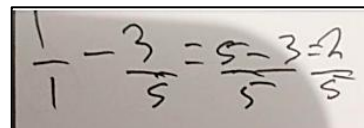

Figure 11. One of the moderate category students' answers to question number 6.

The image above indicates that moderately performing students comprehend the problem in question 6, but they omit some of the given and requested details. In preparing the plan, the students focus directly on solving the problem without outlining a proper strategy. As a result, the implementation of the plan is incorrect. The problem should be solved by division, but the students instead attempt to solve it by subtraction. There are errors in both the calculation process and the final result, indicating that the students are unable to solve the problem correctly.

Figure 12. One of the high category students'
answers to question number 6.

Furthermore, based on the picture above, high-category students understand the problem well, as evidenced by their complete recording of the known and asked information. There are no issues in preparing the plan, which shows that high-category students possess effective problem-solving ability. Even without a concluding statement, the students display sufficient understanding of the problem and are capable of connecting it to practical life situations.

The conclusion drawn from the answers to question number 6 is that students in both the moderate and high categories failed to include a conclusion at the end of their answers.

Question number 7 is as follows:

"Sebuah tali panjangnya $\frac{6}{7}$ meter, kemudian tali itu akan dipotong menjadi 3 bagian sama panjang. Berapa panjang tiap potongan tali tersebut?"

Figure 13. One of the moderate category students'
answers to question number 7.

As shown in the image above, students in the moderate ability group demonstrate an understanding of the problem in question number 7, yet they do not completely write down the known and required information. During the planning

stage, they tend to focus solely on immediately solving the problem rather than outlining a clear strategy. Nonetheless, in the execution phase, the students successfully arrive at the correct solution. This indicates that they understood the intent of question number 7 and solved it accurately, even though they are not in the habit of thoroughly documenting all given and asked elements.

Additionally, the students did not recheck their answers, resulting in one of the answers not being presented in the simplest fraction form. The results above indicate that moderate-category students tend to focus solely on problem-solving without applying the appropriate concepts. It also shows that during the working and calculating process, students did not include conclusions in their answers.
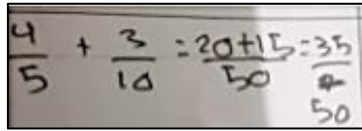

Figure 14. One of the high category students'
answers to question number 7.

In addition, the image above shows that high-ability students clearly understand the problem, as reflected in their complete identification of the known and asked information. They experience no difficulties during the planning stage, indicating that their problem-solving skills support the development of effective solutions. However, they do not include a concluding statement at the end of the process. Despite this, they demonstrate sufficient understanding to apply the problem to real-life situations.

Based on the responses to question number 7, it can be concluded that both moderate- and high-ability students failed to provide a conclusion in their answers.
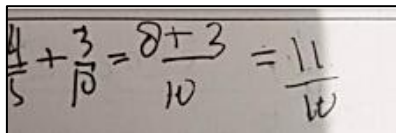
Question number 8 is as follows:

"Hitunglah hasil dari $\frac{4}{5} + \frac{3}{10}$!"

Figure 15. One of the moderate category students' answers to question number 8.

As shown in the image above, students in the moderate category demonstrate a basic understanding of question number 8, but they fail to fully document the known and asked information. In the planning phase, they tend to jump directly into solving the problem without outlining a clear strategy. While some students correctly solve the problem during execution, others make errors. This suggests that, although they grasp the general intent of the question, their understanding remains incomplete. Consequently, several responses are incorrect. Overall, the findings indicate that moderate-level students often prioritize solving the problem without properly applying the relevant mathematical concepts.

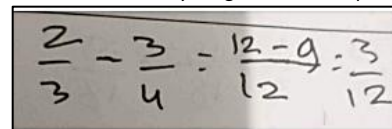Figure 16. One of the high category students' answers to question number 8.

Furthermore, based on the picture above, high-category students understand the problem well, as evidenced by their complete written response, similar to that of medium-category students. In this

problem, no specific information regarding what is known or asked is required. In preparing the plan, there are no difficulties encountered. This indicates that high-category students possess good problem-solving ability and are capable of providing appropriate solutions. However, there is no conclusion written at the end of the problem-solving process. Nevertheless, students have understood the problem sufficiently to solve it through proper application.

The conclusion from the students' answers to question number 8 is that both medium- and high-category students demonstrated similar levels of carefulness in solving the problem.

Question number 9 is as follows:

"Seorang Petani memiliki $\frac{2}{3}$ hektar sawah. Ia menanami. $\frac{3}{4}$ dari sawah tersebut dengan padi. Berapa hektar sawah yang ditanami padi?"

Figure 17. One of the moderate category students' answers to question number 9.

Based on the picture above, moderate-category students understand the problem in question number 9, however, they do not write down complete information. In preparing the plan, the student only focuses directly on solving the problem. In this case, the implementation of the plan is also incorrect. The problem should have been solved using division, but instead, the student mistakenly used subtraction. Errors occur both in the calculation process and in the final result, indicating that the student is unable to solve the problem properly.

Figure 18. One of the high category students' answers to question number 9.

Furthermore, based on the picture above, high-category students demonstrate a good understanding of the problem, as evidenced by their complete writing of the known and asked information. In preparing the plan, there are no issues. This suggests that students with strong problem-solving skills can generate effective solutions. However, they tend to omit a concluding statement. Even so, their understanding is adequate to apply the solution in real-life contexts.

In conclusion, based on student answer number 9, both medium- and high-category students did not write a conclusion at the end of their answers.

From the analysis of answers to questions 1 through 9, it is evident that high-category students show a stronger understanding of the problems than those in the moderate category. High-category students tend capable of stating the given information and what is being sought. information completely and prepare a plan for solving the problem properly. These results are consistent with Polya's problem-solving framework, which highlights the importance of understanding the problem and formulating a strategy as key early stages in solving problems effectively (August & Ramlah, 2021).

However, there is still a common shortcoming among high-category students, namely the lack of habit in writing a final conclusion after solving the problem. This aligns with the study by Sriwahyuni & Maryati (2022), which found that numerous students tend to neglect reflective practices in mathematics, including drawing conclusions and checking their results. Similarly, Putri et al., (2024) found that students often neglect the final stage of problem-solving, which involves reviewing and summarizing their results, even when they have correctly carried out the earlier steps.

In contrast, moderate-category students often skip identifying known and asked elements and jump directly into the computation phase. Their problem-solving approach tends to be procedural without a clear conceptual understanding. Errors such as subtracting instead of dividing suggest a fragile grasp of fundamental mathematical operations. Similar difficulties were reported by Rahayu & Aini (2021), who found that students with only procedural fluency often struggle when confronted with non-routine or multi-step problems.

Furthermore, both moderate and high-category students rarely recheck their work, which leads to minor yet critical errors, such as failing to simplify fractions. This is in line with Damianti & Afriansyah (2022), who highlighted that self-evaluation and reflective thinking contributes significantly to the development of the accuracy and completeness of students' solutions to mathematical problems.

In general, high-category students show stronger problem-solving skills, particularly in problem comprehension and plan execution, whereas moderate-category students often rely on procedural steps with limited conceptual grasp. Both categories of students still need improvement in the aspects of organizing their work clearly, writing final conclusions, and developing the habit of rechecking their answers. This is supported by Berenji (2021), direct teaching of metacognitive strategies can greatly improve students' problem-solving performance. Similarly, Ermawati et al. (2024) discovered that students who were consistently guided in reflection and self-evaluation performed mathematical problem-solving tasks with greater accuracy and consistency.

IV.   CONCLUSION

The results showed that two student (33%) demonstrated high mathematical problem-solving ability (score ≥ 85.7), and five students (67%) demonstrated moderate ability (score between 32.0 and 85.7). No students were categorized as having low ability. Thus, all six students (100%) were assessed.

Overall, fifth-grade students at SDN 1 Dawuan, Cirebon Regency, demonstrated moderate mathematical problem-solving abilities on fraction problems. Common issues included incomplete writing of known and asked information, difficulty interpreting problems, especially in selecting appropriate operations and a lack of habit in reviewing final answers. To address this, teachers should emphasize contextual understanding, guide students through systematic problem-solving steps,

and cultivate habit of drawing conclusions and reviewing answers. This study contributes insights into students' thinking patterns and supports the development of strategies to enhance their metacognitive awareness and mathematical reasoning at the elementary level.

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