

Reflective Thinking Ability of Grade IX Students in Solving Social Arithmetics Problems

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Abstract

This study aims to describe students' reflective thinking abilities in solving social arithmetic problems. A qualitative approach with a case study design was employed. The research subjects were two ninth-grade students at MTs Islamiyah Pakis, selected purposively based on the mathematics teacher's recommendation, consisting of one student with proficient ability and one student with less proficient ability in understanding mathematical tasks. Data were collected through written tests and semi-structured interviews, with the test items constructed based on the three indicators of reflective thinking, namely reacting, comparing, and contemplating. The findings revealed differences in reflective thinking abilities between the two subjects. The student with less proficient ability achieved only the reacting indicator, demonstrating an understanding of the problem but an inability to connect it with prior experiences or reflect on the steps taken. In contrast, the student with proficient ability fulfilled all indicators, showing the ability to understand the problem, relate it to previous experiences, and review and evaluate the process carried out. These results indicate that students with stronger mathematical ability tend to demonstrate more advanced reflective thinking.

Keywords

Reflective thinking, Social arithmetic, Student ability, Qualitative

Introduction

Kusumaningrum (Dian et al., [2018](#)) states that mathematics plays a role in training thinking and reasoning skills to draw conclusions, for example through investigation, exploration, experimentation, and comparing similarities, differences, consistencies, and inconsistencies. Mathematical thinking skills are one indicator of achieving mathematics learning goals, particularly higher-order thinking skills, which include critical, creative, logical, analytical, and reflective thinking. King (Anwar & Sofiyani, [2018](#)) emphasizes that reflective thinking skills are part of these higher-order thinking skills. Dewey ([1993](#)) explained that reflective thinking is an active, diligent, and deliberate thought process based on rational reasoning, enabling one to draw

conclusions or determine solutions to problems faced. In the context of reflective thinking, students can respond to new information received and process existing ideas to formulate next steps (Ramadhani et al., [2023](#)). Similarly, Wahyuni et al. ([2018](#)) added that reflective thinking plays a role in supporting problem solving because it provides an opportunity to learn while considering appropriate strategies in achieving learning goals.

Reflective thinking skills are important for students because they can help them analyze problem-solving strategies, re-understand the process, and correct mistakes to find more appropriate solutions (Adha & Rahaju, [2020](#)). With these skills, students can understand their own learning needs, thus developing an awareness of what they already know and what they still need to learn. This awareness helps them see a problem from multiple perspectives and ultimately achieve more meaningful learning outcomes (Harsoyo & Hakim, [2023](#)).

However, in reality, students' reflective thinking skills are still low. Research by Sihaloho, Zulkarnaen, and Haerudin ([2020](#)) shows that students' mathematical reflective thinking skills are still relatively low. Students tend to be less thorough in understanding problems, connecting information, and drawing accurate conclusions. Furthermore, a lack of persistence in solving problems results in answers that do not meet expectations. Zulfikar (Jannah & Rahaju, [2018](#)) stated that one of the causes is teacher-centered learning, where students only receive information without much opportunity to interact or process knowledge. In mathematics learning, teachers tend to emphasize the final outcome of problem solving rather than tracing students' thought processes. This is in line with the findings of Harel and Sowder (Jannah & Rahaju, [2018](#)) who found that teachers place more emphasis on conveying understanding, but provide less guidance so that students can develop thinking strategies in understanding the material. As a result, students often only focus on the final answer without truly understanding the solution process.

Based on initial observations in ninth-grade students at MTs Islamiyah Pakis, it was found that some students were able to understand the information in the problems and write down the steps to solve them quite well. However, others still needed guidance in interpreting the information and determining the appropriate solution. Students also appeared to experience difficulty when asked to relate previously learned concepts to new, contextual problems. Reflective thinking is necessary in solving various

mathematical problems, including those related to social arithmetic. Social arithmetic is a branch of mathematics that emphasizes calculations related to financial aspects and trade activities in everyday life (Paramitha & Yunianta, [2017](#)). Social arithmetic, a subject in eighth-grade mathematics, involves calculations related to percentages, discounts, profits, and simple interest, which are highly relevant to everyday life. Social arithmetic problems require students to not only memorize formulas but also understand the steps necessary to solve problems logically and systematically.

In this regard, reflective thinking plays a crucial role. Through reflective thinking, students are not only able to solve problems correctly but also able to identify the most appropriate strategy and evaluate the steps taken. Based on the description above, this study aims to analyze the reflective thinking skills of ninth-grade students in solving social arithmetic problems. It is hoped that the results of this study will provide a clearer picture of the level of students' reflective thinking skills and provide insight into the importance of these skills in improving students' understanding of mathematics.

Methodology

This research employed a qualitative approach with a case study approach. The purpose of this study was to describe students' abilities in solving social arithmetic problems. The subjects consisted of two ninth-grade students at MTs Islamiyah Pakis, selected using purposive sampling based on the mathematics teacher's considerations. The criteria were one student with proficient ability and one student with less proficient ability in understanding and solving problems.

The research instruments included a written test and a semi-structured interview guide. The test was designed based on three indicators of reflective thinking skills from Surbeck, Han, and Moyer ([1991](#)): reacting, comparing, and reflecting.

Table 1. Reflective Thinking Indicators

Phase	Indicator
<i>Reacting</i>	<ul style="list-style-type: none"> a. Identify the problem in the question. b. Analyze the known information in the question. c. Explain the relationship of the known information to the problem posed.

	d. Demonstrate that the information obtained is sufficient to answer the question.
<i>Comparing</i>	a. Presenting answers based on previously identified problems. b. Connecting the problem being asked to problems previously encountered.
<i>Contemplating</i>	a. Establishing the intent of the problem. b. Identifying errors in the answer. c. Making corrections and providing explanations if there are errors in the answer. Drawing appropriate conclusions.

Interview guidelines were used to strengthen test results and delve deeper into students' thought processes in solving problems. Interviews were conducted after students completed the test to obtain more in-depth explanations of their reasoning, strategies, and considerations in solving the problems.

Data analysis used the Miles et al. (2014) model, which includes three stages: data reduction, data presentation, and conclusion drawing. Data reduction was achieved by selecting and focusing relevant data, data presentation was done in the form of narrative descriptions, and conclusions were drawn by interpreting the meaning of the data and verifying its consistency. Data validity was achieved through technical triangulation by comparing the results of the written test and interviews.

Result

The study was conducted in two sessions with grade IX students at MTs Islamiyah Pakis. In the first session, the researcher administered a reflective thinking test to two subjects to measure their ability to solve social arithmetic problems. This test aimed to determine the students' process of identifying problems, evaluating answers, correcting errors, and drawing conclusions. After the test, semi-structured interviews were conducted to explore the students' strategies, problem-solving steps, and difficulties. Data from the test and interviews were then coded to facilitate analysis, as shown in [Table 2](#).

Table 2. Subject Coding

Code	Information
S ₁	Subject with less proficient ability
S ₂	Subject with proficient ability
P	Researcher

Exposure and Analysis of Data from the Subject with Less Proficient Ability

The following is an answer sheet that shows a picture of reflective thinking that appears in subjects with less proficient ability.

Reacting

In the Reacting stage, S₁ was able to identify the essential information presented in the problem, including the initial price of the shoes, the discount rate, and the amount of price reduction. S₁ also understood the tasks required, namely determining the price after the discount, calculating the price after the reduction, and comparing the two resulting prices.

This is supported by the following interview transcript.

P : "What can you understand from the problem you have worked on?"

S₁ : "I was asked to find the discounted price, the reduced price, and compare the prices."

P : "What information did you get from the problem?"

S₁ : "The initial price is Rp 400.000, the reduced amount is Rp 50.000, and the discount is 25%."

These responses show that S₁ explicitly identified the key information needed to solve the problem, namely the initial price, the discount rate, and the reduction amount, and accurately restated the required tasks. By actively processing the problem context, S₁ demonstrated an understanding of the essential elements of the task. Therefore, based on these actions, S₁ is considered to have fulfilled the Reacting indicator.

Comparing

In the Comparing stage, S₁ attempted to relate the problem to prior experiences. S₁ mentioned having encountered a similar problem before but could not recall the details or the procedure previously used. This indicates that prior knowledge was not utilized to support the work on the current task.

This is supported by the following interview transcript.

P : "Have you ever encountered a similar problem before?"

S₁ : "Yes, but I forgot the problem."

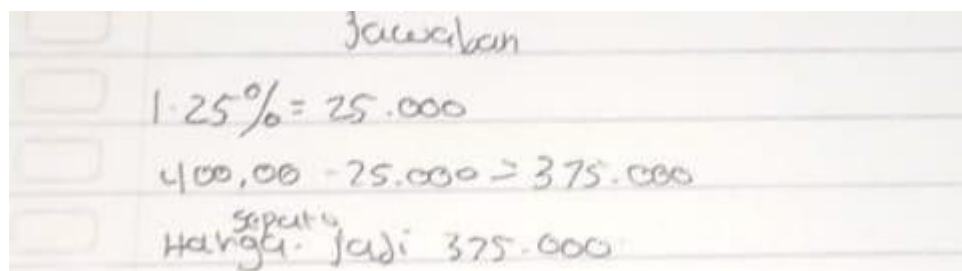
P : "Do you still remember how to solve that problem?"

S₁ : "Not really."

Based on the responses given, S₁ mentioned having encountered a similar problem but could not recall its content or the procedure used. Prior experience was also not utilized to support understanding of the current task. Therefore, based on these actions, S₁ did not fulfilled the Comparing indicator.

Contemplating

Question Number 1



Translate

Answer

1. $25\% = 25.000$

$$400.000 - 25.000 = 375.000$$

Finished shoes price 375.000

Figure 1. S1's Answer Sheet Number 1

In the first number, S1 attempted to determine the price of the shoes after a 25% discount. However, the percentage was misinterpreted as a fixed reduction of Rp 25.000. Based on this misconception, S1 subtracted Rp 25.000 from the original price of Rp 400.000 and obtained Rp 375.000. During the verification stage, no errors were identified because the procedure was perceived as consistent with prior understanding. S1 further explained that the discount was assumed to operate as a nominal deduction rather than a percentage. Despite the conceptual inaccuracy, S1 demonstrated confidence in the answer.

This finding is supported by the following interview transcript:

P : "How did you solve problem number 1?"

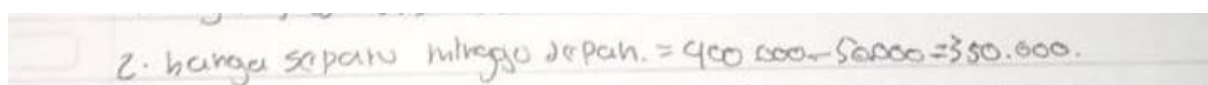
S1 : "I thought 25% meant Rp 25.000, then I subtracted it from Rp 400.000 and got Rp 375.000."

P : "Were you confident about that calculation?"

S1 : "Yes, because that was what I remembered."

Based on this, S1 carried out a verification process but did not detect the conceptual error, and the solution was accepted as correct.

Question Number 2



Translate

2. Shoes prices next week = $400.000 - 50.000 = 350.000$

Figure 2. S1's Answer Sheet Number 2

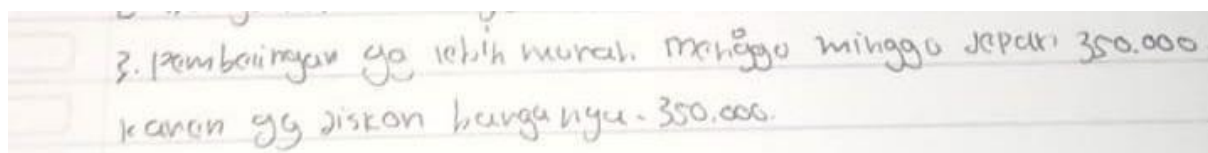
In the second number, S1 correctly identified the task as determining the price after a fixed reduction of Rp5,000. S1 performed a direct subtraction from the initial price of Rp400.000, yielding Rp350.000. Although the computation was correct, S1 did not evaluate the result in relation to the earlier misconception. When prompted to review the procedure, no errors were reported, and the answer was justified as a simple subtraction. Despite the limited evaluative reasoning, S1 expressed confidence in the final result.

This finding is supported by the following interview transcript:

- P : "How did you solve problem number 2?"
S1 : "I subtracted Rp 50.000 from Rp 400.000 and got Rp 350.000."
P : "Did you review the result?"
S1 : "Yes, and I felt it was correct."

Based on this, S1 verified the answer only procedurally and did not relate it to the incorrect reasoning in the previous problem.

Question Number 3



Translate

3. More purchases, cheaper waiting for next week = 350.000, because the price is discounted = 350.000

Figure 3. S1's Answer Sheet Number 3

In the third number, S1 attempted to determine which option produced a lower final price by comparing the outcomes of the previous calculations. Based on the earlier results, the fixed-reduction price of Rp 350.000 was judged to be lower than the discounted price of Rp 375.000. S1 did not identify the underlying misconception from the first problem and did not perform any corrective verification. Nevertheless, a rationale consistent with the prior answers was provided, and strong confidence in the conclusion was expressed despite the conceptual inaccuracy.

This finding is supported by the following interview transcript:

- P : "How did you answer problem number 3?"
S1 : "I compared the two prices. The one with the fixed reduction became Rp 350.000, and the discounted one became Rp 375.000."
P : "Why did you choose the fixed-reduction price as cheaper?"
S1 : "Because Rp 350.000 is lower, so that's the cheaper one."

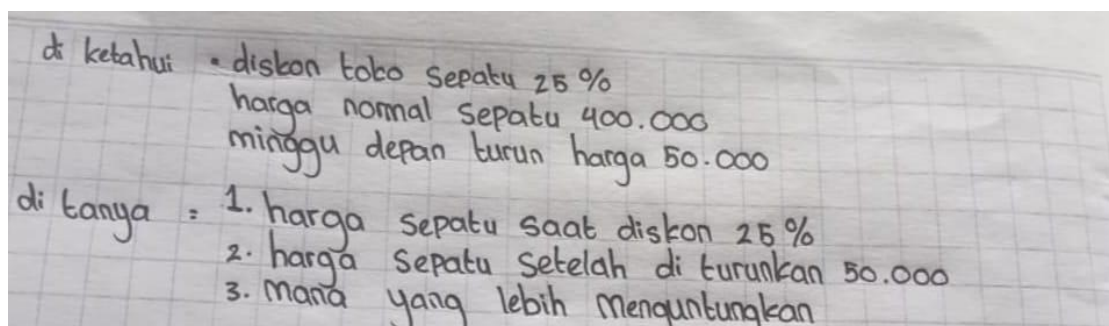
Based on this, S1 compared the results but did not re-evaluate the validity of the earlier reasoning, leading to a conclusion constructed on an inaccurate assumption.

These findings indicate that S1 appeared confident in the responses provided but did not review or re-evaluate the calculations. Consequently, the conclusion drawn was not aligned with the correct mathematical concept. Thus, S1 did not fulfilled the Contemplating indicator, as the accuracy and coherence of the solution process were not verified.

Exposure and Analysis of Data from the Subject with Proficient Ability

The following is an answer sheet that shows a picture of reflective thinking that appears in subjects with proficient ability.

Reacting



Translate

Given:

Shoe store discount 25%

Normal shoes price 400.000

Next week price will be reduced by 50.000

Question:

1. Shoes price with 25% discount
2. Shoes price after 50.000 discount
3. Which is more profitable?

Figure 4. S1's Answer Sheet

Based on [Figure 5](#), S2's answer sheet shows that the student listed the given data, including the initial price of the shoes, the amount of price reduction, and the discount percentage. S2 also identified what the problem asked for, indicating an understanding of the task. This is supported by the following interview transcript.

P : "What do you understand from the problem you solved?"

S2 : "Finding the price of shoes after a discount, the price after a reduction, and comparing the prices."

P : "What information did you obtain from the problem?"

S2 : "The initial price was Rp 400.000, there was a reduction of Rp 50.000, and a 25% discount."

Based on the written work and interview responses, S2 identified the key information in the problem and clearly stated the tasks to be completed. These actions show that S2 understood the problem and recognized the relevant data needed to begin solving it. Therefore, S2 fulfilled the Reacting indicator.

Comparing

In the Comparing stage, S2 demonstrated the ability to connect the problem with previous learning experiences. S2 stated that they had encountered similar problems before and still remembered how to solve them. This prior knowledge helped S2 in recognizing the pattern of discount calculations and determining the appropriate steps for solving the tasks. This is supported by the following interview transcript.

P : "Have you ever received a similar problem before?"

S2 : "Yes, I have."

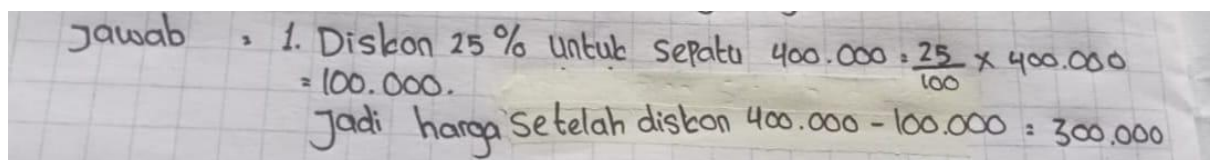
R : "Do you still remember how to solve it?"

S2 : "Yes, I remember."

Based on these responses, S2 explicitly recalled having worked on similar problems and indicated remembering the procedure for solving them. This prior understanding was used to recognize the structure of the current problem and to determine the appropriate steps for completing the tasks. By drawing on previous experience to guide the solution process, S2 fulfilled the Comparing indicator.

Contemplating

Question Number 1



Translate

1. Answer: 25% discount on shoes 400.000 = $\frac{25}{100} \times 400.000$

So, the price after the discount is 400.000 - 100.000 = 300.000

Figure 5. S2's Answer Sheet Number 1

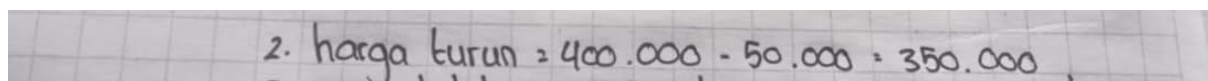
In the first number, S2 identified the purpose of the task as determining the price of the shoes after a 25% discount. The percentage was converted into its $\frac{25}{100}$ and multiplied by the original price of Rp 400.000 to obtain a discount of Rp 100.000. After reviewing the steps, no errors were identified, and the procedure was judged consistent with standard discount calculations. S2 justified the method by explaining that percentages must be expressed in decimal form before being applied. Based on this reasoning, S2 concluded confidently that the final price after the discount was Rp 300.000.

This finding is supported by the following interview transcript:

- P : "How did you solve item number 1?"
 S2 : "I changed 25% into $\frac{25}{100}$, then multiplied it by Rp 400.000 and got Rp 100.000, then subtracted it so the result was Rp 300.000."
 P : "Do you think your answer is correct?"
 S2 : "Yes, this is the usual way I calculate discounts."

In this number, S2 reviewed the calculation steps, checked for errors, confirmed that the procedure matched the formula for percentage-based discounts, and provided justification for the method used.

Question Number 2



Translate

2. Price drops = $400.000 - 50.000 = 350.000$

Figure 6. S2's Answer Sheet Number 2

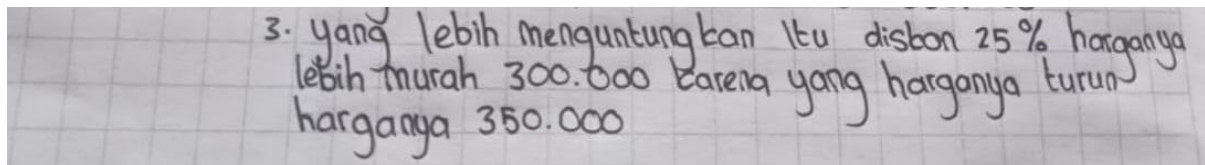
In the second number, S2 identified the task as determining the price after a fixed reduction of Rp 50.000. The computation was carried out through direct subtraction, reducing the original price of Rp 400.000 to Rp 350.000. After reviewing the steps, no errors were identified, as the procedure involved only a straightforward deduction. S2 justified the method by noting that a fixed reduction does not require percentage operations. Despite the simplicity of the calculation, S2 expressed confidence in the accuracy of the result.

This finding is supported by the following interview transcript:

- P : "How did you solve problem number 2?"
 S2 : "I just subtracted Rp 400.000 by Rp 50.000, and it became Rp 350.000."
 P : "Did you double-check your answer?"
 S2 : "Yes, because it's only a direct reduction, so you just subtract it."

In this number, S2 rechecked the subtraction process, verified that no miscalculation occurred, and justified the suitability of the method for a fixed-reduction context.

Question Number 3



Translate

3. The more profitable one is a 25% discount, the price is 300.000 cheaper because the price that has dropped is 350.000

Figure 7. S2's Answer Sheet Number 3

For the third number, S2 identified the purpose of the task as determining the lower price between the discounted option and the fixed-reduction option. S2 reviewed the results from the previous calculations and compared the two values. No errors were identified during the rechecking process, so no revisions were made. Based on the reasoning that a 25% discount produces a Rp 100.000 reduction greater than the fixed reduction of Rp 50.000, S2 concluded that the discounted price of Rp 300.000 was lower. S2 also expressed confidence in this conclusion.

This finding is supported by the following interview transcript:

P : "How did you answer problem number 3?"

S2 : "I compared the two results. The discounted price became Rp 300.000, and the fixed-reduction price became Rp 350.000."

P : "Why is the discounted price considered cheaper?"

S2 : "Because the discount is more worth it because the price becomes Rp 300.000, compared to the other option where the price only drops by Rp 350.000."

In this number, S2 reviewed earlier solutions, confirmed the correctness of each result, and used logical comparison to support the conclusion regarding the cheaper option

Based on the [Figure 5](#), [6](#), [7](#) and the interview, S2 fulfilled the Contemplating indicator, demonstrating the ability to review the solution steps, ensure consistency, and logically justify the answers.

Discussion and Conclusion Discussion

The research findings show differences in reflective thinking skills between the subject with less proficient ability (S1) and the subject with proficient ability (S2) in solving social

arithmetic problems. S₁ was only able to fulfilled the Reacting indicator, whereas S₂ fulfilled all three reflective thinking indicators: Reacting, Comparing, and Contemplating. This difference illustrates variations in the ability to understand the problem, connect it with prior experiences, and review the solution process.

At the Reacting indicator, S₁ was able to identify essential information and understand the question. However, this initial understanding was not followed by further reflective processes, such as linking the task to previous experiences or evaluating the accuracy of the result. This condition indicates that S₁ had not yet engaged in a deeper level of reflection. These findings are consistent with the explanation of Noviyanti, Purnomo, and Kusumaningsih (2021), who state that students with weaker reflective thinking skills generally achieve only the reacting indicator. This pattern is also supported by the study of Junaedi, Maryam, and Lutfi (2022), who reported that students with less proficiency tend to complete reflective thinking tasks in an incomplete and unsystematic manner, which is demonstrated by S₁'s inability to fulfill the comparing and contemplating indicators.

In contrast, S₂ exhibited more comprehensive reflective thinking skills. In the Reacting stage, S₂ understood the problem and accurately identified the relevant information. In the Comparing stage, S₂ connected the given problem to prior knowledge or similar experiences. In the Contemplating stage, S₂ reviewed the solution steps, checked the accuracy of the results, and provided logical justification. These findings are consistent with Adha and Rahaju (2020), who explain that students with strong reflective thinking skills are capable of analyzing and evaluating their problem-solving processes based on their knowledge and awareness. The results reported by Arwadi, Darwis, and Syam (2025) also support this pattern, indicating that students with good mathematical abilities tend to demonstrate strong reflective thinking skills because all phases of reflective thinking, namely reacting, comparing, and contemplating, can be fulfilled. Thus, the reflective thinking demonstrated by S₂ reinforces previous findings that emphasize the close association between mathematical ability and the completeness of reflective thinking processes.

Overall, the difference in the fulfillment of reflective indicators between S₁ and S₂ shows that higher levels of ability are associated with deeper reflective thinking.

Conclusion

The results of this study indicate a clear difference in reflective thinking skills between the two subjects. The subject with less proficient ability (S₁) was only able to fulfill the

Reacting indicator, showing an understanding of the task but not relating it to prior experiences or engaging in deeper reflection on the process undertaken. In contrast, the subject with proficient ability (S₂) fulfilled all three reflective thinking indicators, namely Reacting, Comparing, and Contemplating, demonstrating the ability to understand the task, connect it with previous experiences, and review as well as evaluate the steps taken during the completion process. These findings suggest that students with higher levels of ability tend to demonstrate more advanced reflective thinking.

It is recommended that students with less proficient ability be more frequently engaged in activities that encourage reflection, such as reviewing the steps they have taken, comparing new tasks with those previously encountered, and discussing strategies for evaluating results. Students with proficient ability are encouraged to continue developing their reflective thinking skills through more complex activities that require deeper analysis of the processes they use. Overall, educators are advised to create learning environments that support the development of all reflective thinking indicators so that students can optimize their reflective abilities in mathematical activities.

Declarations

Competing Interests

The authors state that they have no conflicts of interest related to the publication of this work.

Data Availability

The data supporting the findings of this study can be obtained from the corresponding author upon reasonable request.

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