

## Exploring Junior High School Students' Mathematical Problem-Solving Abilities in Linear Equations Based on Cognitive Style

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### ABSTRACT

This study explores junior high school students' mathematical problem-solving abilities in the topic of linear equations based on their cognitive styles. A qualitative case study design was employed involving 13 ninth-grade students from SMP Negeri 6 Watubangga, Southeast Sulawesi, Indonesia. Students' cognitive styles were identified using the Matching Familiar Figures Test (MFFT), resulting in the classification of nine impulsive and four reflective students. Four participants, consisting of two impulsive and two reflective students with moderate mathematical ability, were purposively selected for in-depth analysis. Data were collected through a mathematical problem-solving test on linear equations, semi-structured interviews, and documentation. Data analysis followed the interactive model of Miles, Huberman, and Saldaña, including data condensation, data display, and conclusion drawing and verification. Students' problem-solving performance was analyzed using Polya's four-stage framework: understanding the problem, devising a plan, carrying out the plan, and looking back. The findings revealed clear differences between impulsive and reflective students across the problem-solving stages. Impulsive students tended to respond quickly but often failed to identify relevant information, develop systematic solution plans, and verify their answers, resulting in procedural and computational errors. In contrast, reflective students demonstrated more organized and systematic problem-solving processes, carefully selecting strategies and reviewing their work before reaching conclusions. These findings highlight the importance of considering cognitive styles when designing adaptive mathematics instruction to enhance students' problem-solving abilities.

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## 1. INTRODUCTION

Problem-solving ability is a fundamental component of mathematics learning because it enables students to develop critical, analytical, and creative thinking skills. According to Siswanto (2024), problem-solving skills are closely related to real-life situations and can be applied to address various challenges encountered in

everyday contexts. At the junior high school level, the topic of linear equations requires students to apply problem-solving skills, particularly in integrating graphical and algebraic representations. However, many students continue to experience difficulties in understanding key concepts such as the Cartesian coordinate system, intercepts, and slope when studying linear equations (Hanum et al., 2020). These difficulties indicate that students often struggle not only with conceptual understanding but also with selecting and implementing appropriate solution strategies. Furthermore, variations in students' cognitive characteristics may influence how they interpret mathematical information and solve mathematical problems. Consistent with this issue, Solihat and Roesdiana (2022) reported that students' problem-solving abilities in the topic of linear equations remain below the expected standards for mathematical problem solving. This condition highlights the need to investigate factors that may contribute to these differences, including students' cognitive styles.

Cognitive style refers to an individual's characteristic way of processing information, making decisions, and solving problems. Pambudi et al. (2020) define cognitive style as a relatively stable and consistent characteristic associated with the use of cognitive functions, including thinking, remembering, problem solving, and decision making. Various classifications of cognitive styles have been proposed in the literature. Among them, reflective and impulsive cognitive styles are commonly found among junior high school students (Cisilia et al., 2024). Students with a reflective cognitive style tend to respond more slowly because they carefully consider and evaluate multiple alternatives before making a decision. In contrast, students with an impulsive cognitive style generally provide rapid responses but are more likely to make errors due to insufficient verification of their answers (Kritis et al., 2023). These differences suggest that cognitive style may significantly influence how students approach mathematical tasks, particularly topics such as linear equations that require careful analysis and accuracy.

The relationship between cognitive style and problem-solving ability can be understood through the different strategies students employ when solving mathematical problems. Rismen et al. (2023) explain that reflective and impulsive cognitive styles differ primarily in cognitive tempo, namely the amount of time individuals use to process information and formulate responses. Students with a reflective cognitive style tend to engage in more thorough evaluation of available information and alternative solution paths before concluding (Nasriadi et al., 2019). Conversely, students with an impulsive cognitive style are inclined to respond quickly, often without adequately reviewing the accuracy of their reasoning. Such differences may lead to substantial variations in problem-solving performance, particularly when students are confronted with linear equation problems that require precise interpretation of data, accurate calculations, and appropriate selection of solution methods. As noted by Lisa et al. (2024), cognitive style plays an important role in determining how effectively students overcome mathematical challenges, especially those requiring careful reasoning and systematic evaluation.

Numerous studies have examined students' mathematical problem-solving abilities in relation to reflective and impulsive cognitive styles. Kurniawati et al. (2022) found that students with a reflective cognitive style tend to demonstrate more systematic and accurate problem-solving processes. In contrast, impulsive

students often solve problems hastily and rarely recheck their work. Similar findings were reported by Handini et al. (2023) and Ulya et al. (2023), who showed that reflective students outperformed impulsive students in solving mathematical problems and exhibited greater accuracy in completing tasks. Furthermore, Lutfia and Mulyawati (2025) emphasized that cognitive style plays a crucial role in mathematical problem solving, as impulsive students frequently prioritize speed over accuracy, resulting in less precise solutions. Likewise, Oktaviani et al. (2020) reported that reflective students generally spend more time evaluating their answers and verifying solution procedures. In contrast, impulsive students tend to provide immediate responses without sufficient review, leading to a higher likelihood of inaccuracies. Although these studies consistently demonstrate differences in problem-solving performance between reflective and impulsive learners, most investigations have focused on general mathematical topics and have provided limited insight into how each cognitive style influences specific stages of problem solving within the context of linear equations.

Despite the growing body of research on cognitive styles and mathematical problem solving, an important research gap remains. Previous studies have largely examined problem-solving ability in a general sense, with limited attention given to how reflective and impulsive cognitive styles influence students' performance at each stage of the problem-solving process in the topic of linear equations at the junior high school level. Consequently, detailed information regarding the characteristics of students' problem-solving processes based on cognitive style remains insufficient. The novelty of this study lies in its integration of cognitive style analysis with a stage-based examination of mathematical problem solving in the context of linear equations. By exploring how students with reflective and impulsive cognitive styles perform at each problem-solving stage, this study provides a more comprehensive understanding of the cognitive processes underlying students' mathematical performance. The findings are expected to contribute to the development of adaptive mathematics instruction that accommodates differences in students' cognitive characteristics and supports more effective learning outcomes.

This study aims to explore junior high school students' problem-solving abilities in the topic of linear equations based on their cognitive styles. Specifically, the study investigates how students with reflective and impulsive cognitive styles perform across different stages of mathematical problem solving. The study is expected to provide empirical evidence regarding the role of cognitive style in shaping students' problem-solving performance and to offer practical implications for the design of instructional strategies that are responsive to students' cognitive characteristics. Ultimately, the findings may assist mathematics educators in improving the effectiveness of learning activities and enhancing students' problem-solving abilities. Accordingly, the research questions are as follows:

1. How do students with reflective and impulsive cognitive styles demonstrate problem-solving abilities in the topic of linear equations?
2. How do the problem-solving stages differ between students with reflective and impulsive cognitive styles?

## **2. METODE**

### **2.1. Research Design**

This study employed a qualitative research design using a case study approach to explore junior high school students' mathematical problem-solving abilities in the topic of linear equations based on their cognitive styles, specifically reflective and impulsive cognitive styles. A qualitative case study was selected because it enables an in-depth examination of students' cognitive processes and problem-solving strategies through rich descriptive data obtained from multiple sources (Putri et al., 2025). The study was conducted in November at SMP Negeri 6 Watubangga, Kolaka Regency, Southeast Sulawesi.

The participants consisted of 13 ninth-grade students who initially completed the cognitive style assessment. Subsequently, four students were purposively selected as research subjects based on the results of the cognitive style test, comprising two students with a reflective cognitive style and two students with an impulsive cognitive style. To ensure comparability of responses and to minimize the influence of mathematical achievement differences, the selected participants were students with moderate mathematical ability levels. This sampling strategy allowed the researchers to obtain detailed information regarding variations in problem-solving processes associated with different cognitive styles.

### **2.2. Instruments and Data Collection**

In qualitative research, the researcher served as the primary instrument responsible for designing the study, collecting data, interpreting participants' responses, and drawing conclusions. To support the data collection process, several supplementary instruments were employed, including the Matching Familiar Figures Test (MFFT), a mathematical problem-solving test on the topic of linear equations, and a semi-structured interview guide. The MFFT was used to identify students' cognitive styles, particularly reflective and impulsive cognitive styles, and was adapted from Herianto, (2020), who developed and validated the instrument for use in the Indonesian educational context.

The mathematical problem-solving test consisted of three closed-ended essay questions designed to assess students' conceptual understanding and routine problem-solving abilities related to linear equations. In addition, a semi-structured interview guide was developed to explore students' thought processes, reasoning patterns, and solution strategies in greater depth. Both the mathematical test and interview protocol were developed by the researchers and validated by experts in mathematics and mathematics education to ensure content relevance, appropriateness of difficulty level, and clarity of instructions. The validation results indicated that all instruments were suitable for use in the study.

The interview guide was constructed based on an extensive literature review and preliminary testing to ensure consistency and clarity in eliciting students'

cognitive processes. Particular attention was given to identifying characteristics of impulsive strategies, which tend to be rapid but less accurate, and reflective strategies, which are generally more systematic, careful, and analytical. Data collection was conducted in several stages. First, students completed the MFFT to determine their cognitive styles and identify potential research subjects. Second, selected participants completed the mathematical problem-solving test, and their written responses were collected for analysis. Third, in-depth semi-structured interviews were conducted to clarify students' reasoning processes and solution strategies. Finally, students' written work and interview recordings were documented as supporting evidence for the analysis.

### **2.3. Data Analysis**

Data analysis followed the interactive model proposed by Miles et al. (2014), which consists of three interconnected stages: data condensation, data display, and conclusion drawing and verification. These stages were conducted iteratively throughout the research process to obtain a comprehensive understanding of students' mathematical problem-solving abilities in relation to their cognitive styles. The analysis of problem-solving ability was guided by (Polya, 1973) problem-solving framework, which includes four stages: understanding the problem, devising a plan, carrying out the plan, and looking back.

The first stage, data condensation, involved selecting, focusing, simplifying, and organizing relevant information obtained from the MFFT results, mathematical problem-solving tests, and interview transcripts. During this process, data related to students' cognitive styles and problem-solving performance were identified, coded, and categorized according to Polya's problem-solving indicators. The second stage, data display, involved organizing and presenting the condensed data in a systematic and meaningful manner. Data from the cognitive style assessment, written responses, and interview findings were grouped based on the four stages of Polya's framework to facilitate interpretation and comparison between students with reflective and impulsive cognitive styles.

The final stage consisted of drawing conclusions and verifying the findings. Conclusions were developed by identifying recurring patterns in students' performance across the stages of understanding the problem, devising a plan, carrying out the plan, and looking back. These conclusions were continuously refined throughout the analysis process. To enhance the trustworthiness of the findings, triangulation was conducted by comparing information obtained from multiple data sources, namely the MFFT results, students' written responses, and interview data. Furthermore, the analysis results were reviewed by experts to strengthen the credibility, dependability, and confirmability of the study findings.

### 3. RESULTS AND DISCUSSION

#### 3.1. Results

The study began with the administration of the Matching Familiar Figures Test (MFFT) to identify students' cognitive styles. The classification was based on two primary indicators, namely response time and the number of errors. These indicators were used to distinguish students with reflective and impulsive cognitive styles. The results showed that nine of the thirteen participants were classified as impulsive, whereas four students were classified as reflective. Based on these results, two students from each cognitive-style group were selected as research subjects for an in-depth analysis of their mathematical problem-solving processes on the topic of linear equations.

To examine students' problem-solving abilities, their written responses were analyzed using Polya's four stages of problem solving: understanding the problem, devising a plan, carrying out the plan, and looking back. The analysis revealed distinct characteristics between students with impulsive and reflective cognitive styles. A summary of these characteristics is presented in Table 1.

**Table 1.** Characteristics of Impulsive and Reflective Cognitive Styles in Mathematical Problem Solving

Task	Impulsive Cognitive Style	Reflective Cognitive Style
<b>Problem 1</b>	Did not identify known and unknown information; directly applied the slope formula; calculation steps were incomplete and unsystematic; incorrect slope value obtained.	Identified known points and relevant information; applied the slope formula correctly; calculation steps were systematic and well organized; correct slope value obtained.
<b>Problem 2</b>	Only wrote the linear equation formula; solution process was not completed.	Identified known and unknown information; applied the linear equation formula appropriately; solution process was not completed.
<b>Problem 3</b>	Directly substituted values into the equation; algebraic errors occurred; no verification of the answer	Restated the given equation before solving; performed substitution step by step; clearly presented the final answer.

As shown in Table 1, students with an impulsive cognitive style tended to solve problems rapidly but with limited accuracy. Their solutions often lacked complete reasoning, contained computational errors, and rarely included verification of results. In contrast, students with a reflective cognitive style demonstrated a more systematic problem-solving process, characterized by organized solution steps, careful calculations, and greater attention to the accuracy of their answers. Although some reflective students did not complete all problems successfully, their written work indicated a more structured approach to problem solving.

Examples of students' written responses are presented in Figures 1 and 2. Figure 1 illustrates the work of an impulsive student (S-01), while Figure 2 presents the response of a reflective student (S-02). In Problem 1, the impulsive student (S-01) immediately performed calculations without first identifying the known and

unknown information. The student directly applied a memorized formula and proceeded through several incomplete computational steps, which ultimately resulted in an incorrect solution. This behavior indicates weaknesses in the stages of understanding the problem and planning a solution. The interview findings supported this observation. When asked about the solution process, S-01 stated, "I usually start calculating immediately using the formula that I remember. I do not write down all the information first because I want to finish quickly." This response suggests a tendency to prioritize speed over careful analysis, which is consistent with the characteristics of an impulsive cognitive style.

1.  $m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$   
 $= \frac{-2 - 4}{5 - (-3)} = \frac{-6}{-8}$   
 $= \frac{-3}{-4}$

2.  $y = mx + c$

3.  $y - 2x = 0$   
 $y + 7 = 0$   
 $y = -2$

**Figure 1.** Student Response (S-01) with an Impulsive Cognitive Style

A similar pattern emerged in Problem 2. The impulsive student wrote only the general form of the linear equation but was unable to continue the solution process until completion. The work stopped midway without further explanation or justification. During the interview, another impulsive student (S-03) explained, "I knew the formula because I learned it from a friend, but I did not know what to do next." This statement indicates that the student possessed partial procedural knowledge but experienced difficulties in selecting and implementing an appropriate solution strategy. In Problem 3, the impulsive student directly substituted values into an equation without first organizing the available information or checking the validity of the procedure. Several algebraic inaccuracies were identified, and no attempt was made to verify the final result. When asked whether the answer had been reviewed, S-01 responded, "I rarely check my answers again because I usually think the first answer is already correct." This finding demonstrates limited engagement in Polya's final stage of looking back.

The interview data from the second impulsive participant (S-03) further confirmed these characteristics. Similar to S-01, S-03 tended to focus on applying formulas immediately rather than analyzing the information provided in the problem. During the interview, S-03 stated, "When I see a mathematics problem, I usually look for a formula first because I think it will help me get the answer faster." When asked about writing down the known and unknown information, the student responded, "I usually skip that part because I feel it takes too much time." These responses indicate that S-03 experienced difficulties in the stages of understanding the problem and devising a plan. In addition, the student acknowledged rarely reviewing completed work, stating, "If I have found an answer, I usually move on to

the next question without checking it again." This finding reinforces the tendency of impulsive students to prioritize speed over accuracy and verification.

**Figure 2.** Student Response (S-02) with a Reflective Cognitive Style

In contrast, the reflective student (S-02), whose work is shown in Figure 2, demonstrated a more systematic approach across all stages of problem solving. In Problem 1, the student first identified the known coordinates, then selected the appropriate slope formula, and completed the calculations in a sequential manner. This performance reflects the successful implementation of the stages of understanding the problem, devising a plan, and carrying out the plan. The interview data further supported this finding. S-02 stated, "I always write down the given information first so that I do not forget anything and can check each step carefully." Such a response illustrates the deliberate and analytical nature of reflective students when approaching mathematical tasks.

The characteristics of the second reflective participant (S-04) were generally consistent with those observed in S-02. During the interview, S-04 explained, "I prefer to read the question several times before deciding which formula to use because I want to make sure I understand what is being asked." The student also emphasized the importance of organizing information before performing calculations, stating, "Writing down the given information helps me determine the correct steps and avoid mistakes." Furthermore, S-04 reported routinely reviewing solution procedures, noting that "I always check my calculations again because sometimes small mistakes can change the final answer." These responses indicate that S-04 demonstrated strong engagement in the stages of understanding the problem, devising a plan, and looking back, which are characteristic features of a reflective cognitive style.

In Problem 2, the reflective student identified the known and unknown information and applied the linear equation formula appropriately. However, the solution was not completed due to difficulties in interpreting the subsequent steps. During the interview, S-02 explained, "I understood the formula, but I was not fully sure how to continue solving the problem." Although the final solution was incomplete, the student's work showed evidence of systematic reasoning and a clear attempt to develop an appropriate solution plan. This contrasts with the impulsive students, whose solutions often lacked a structured problem-solving process.

For Problem 3, the reflective student restated the given equation, performed substitutions gradually, and clearly presented the final answer. In addition, evidence of verification was found in the written work, indicating engagement in Polya's

looking-back stage. During the interview, S-02 remarked, “*Before submitting my work, I usually review each step to make sure there are no mistakes.*” This finding suggests that reflective students not only focus on obtaining answers but also emphasize the accuracy and consistency of their reasoning. Overall, the results indicate that students with a reflective cognitive style exhibit stronger performance across Polya’s problem-solving stages than students with an impulsive cognitive style, particularly in organizing information, implementing solution strategies systematically, and verifying the correctness of their answers.

### 3.2. Discussion

The findings of this study revealed clear differences between students with impulsive and reflective cognitive styles in solving linear equation problems, both in terms of solution quality and problem-solving processes. These findings indicate that cognitive style influences how students understand problems, develop solution plans, implement strategies, and evaluate their answers. Students with a reflective cognitive style demonstrated a more systematic and organized approach, whereas students with an impulsive cognitive style tended to prioritize speed over accuracy. These results are consistent with the findings of Anugraheni et al. (2019), who reported that cognitive style significantly affects the quality of mathematical problem solving among junior high school students. Similar conclusions were drawn by Aini et al. (2020), who found that impulsive and reflective students exhibit distinct thinking patterns across Polya’s problem-solving stages. Furthermore, Bohalima, (2022) emphasized that cognitive style is an important internal factor influencing students’ decision-making processes during mathematical problem solving.

Students with an impulsive cognitive style in this study tended to solve problems rapidly but in a less structured manner. They frequently applied formulas immediately without first identifying the given and required information, resulting in incomplete or disorganized solution procedures. This finding is consistent with Nurmutia (2019), who reported that impulsive students often bypass the stages of understanding the problem and planning a solution. Similarly, Asmaun (2024) found that impulsive students tend to rely more on memorized formulas than on conceptual analysis, making them more susceptible to procedural errors. Mirlanda et al. (2019) also noted that the tendency to respond hastily often prevents impulsive students from following a systematic problem-solving process.

When viewed through the lens of Polya’s problem-solving framework, students with an impulsive cognitive style appeared to experience difficulties primarily during the stages of understanding the problem and devising a plan. Many students moved directly to the execution stage without carefully analyzing the information provided in the problem. This observation supports the findings of Irfana and Ismail (2024), who reported that impulsive students frequently initiate solution procedures before establishing a clear plan. Likewise, Kabiran et al. (2019) found that impulsive learners often struggle to connect problem information with appropriate solution strategies. Rismen et al. (2023) further argued that impulsive characteristics limit students’ consideration of alternative strategies, thereby reducing the effectiveness of their problem-solving processes.

Another notable finding was that impulsive students rarely engaged in the final stage of Polya's framework, namely looking back. Most students showed strong confidence in their initial responses and therefore seldom reviewed their solutions for possible conceptual or computational errors. This tendency is consistent with the findings of Rohmah et al. (2020), who reported that impulsive students generally demonstrate lower levels of reflection on their completed work. Similarly, Rahayu and Winarso (2018) found that impulsive learners often submit answers without conducting a final evaluation. Jamil et al. (2022) further concluded that the lack of answer verification is one of the primary causes of errors in mathematical problem solving among impulsive students.

In contrast, students with a reflective cognitive style demonstrated a more systematic and structured problem-solving process. They typically identified the given and required information before performing calculations and carefully selected solution strategies. These behaviors indicate stronger performance in the stages of understanding the problem and devising a plan. The findings align with those of Andayani et al. (2019), who reported that reflective students tend to complete all stages of mathematical problem solving more comprehensively. Similarly, Rahmmatiya et al. (2020) found that reflective students possess stronger abilities to organize and interpret information when solving mathematical tasks. Nurmutia (2019) also emphasized that the careful and deliberate nature of reflective learners contributes to clearer and more coherent solution procedures.

The results further showed that reflective students regularly reviewed their work before reaching a final answer. This practice reflects active engagement in Polya's looking-back stage and contributes to the accuracy of their solutions. However, several reflective students were unable to complete some problems successfully. The evidence suggests that these difficulties were primarily related to conceptual understanding rather than carelessness or haste. This finding is consistent with Yuhani et al. (2018), who reported that reflective students tend to work carefully but may encounter obstacles when confronted with challenging concepts. Likewise, Febrianti et al. (2021) found that reflective learners prioritize procedural accuracy over speed. Utami et al., (2020) further concluded that incomplete solutions produced by reflective students are more often associated with conceptual limitations than with procedural mistakes.

The differences observed between impulsive and reflective students suggest that successful mathematical problem solving depends not only on mastery of formulas and procedures but also on the regulation of cognitive processes throughout the problem-solving cycle. Students who carefully analyze information, plan solution strategies, and evaluate their answers are more likely to achieve accurate outcomes. These findings support Fauziah et al. (2022), who argued that mathematical problem solving requires metacognitive competencies that vary across cognitive styles. Similarly, Wicaksono et al. (2023) reported that impulsive students often struggle with problems requiring sequential reasoning, whereas reflective students are generally better able to adapt to complex problem situations. Mulyaningsih et al. (2018) also found that cognitive style influences the flexibility of students' problem-solving strategies.

This study contributes to the growing body of research on mathematical problem solving by providing a detailed analysis of how reflective and impulsive

cognitive styles influence students' performance at each stage of Polya's problem-solving framework within the context of linear equations. While previous studies have generally focused on differences in overall problem-solving performance, the present study offers a more nuanced understanding of how cognitive style shapes students' behaviors during the processes of understanding problems, planning solutions, implementing strategies, and evaluating results. These findings provide practical implications for mathematics instruction by highlighting the importance of designing learning activities that accommodate diverse cognitive characteristics. Teachers may support impulsive students by encouraging systematic planning and answer verification, while reflective students may benefit from instructional interventions aimed at strengthening conceptual understanding and problem-completion skills.

Overall, the findings of this study are consistent with previous research indicating that impulsive and reflective cognitive styles exhibit distinct characteristics in mathematical problem solving. Students with an impulsive cognitive style tend to excel in response speed but demonstrate weaknesses in accuracy, organization, and evaluation. Conversely, students with a reflective cognitive style generally show greater accuracy and more systematic reasoning, although they may require additional time and conceptual support to complete complex tasks. These findings support the conclusions of Awaliya (2022), Sukma et al. (2019), and Ningsih et al. (2023), all of whom emphasized the importance of considering cognitive style differences in mathematics education at the junior high school level.

#### **4. CONCLUSION**

This study aimed to explore junior high school students' mathematical problem-solving abilities in the topic of linear equations based on their cognitive styles and to identify differences in problem-solving stages between reflective and impulsive students. The findings indicate that cognitive style plays an important role in shaping students' problem-solving performance. Students with an impulsive cognitive style tended to solve problems quickly but less systematically. They frequently omitted the stages of identifying relevant information, planning solution strategies, and verifying their answers. As a result, their solutions often contained procedural and computational errors. In terms of Polya's problem-solving framework, impulsive students demonstrated weaknesses in the stages of understanding the problem, devising a plan, and looking back. In contrast, students with a reflective cognitive style exhibited a more structured and systematic problem-solving process. They generally identified the known and unknown information, selected solution strategies carefully, performed calculations sequentially, and reviewed their work before determining a final answer.

The findings further reveal clear differences between reflective and impulsive students across the stages of problem solving. Reflective students demonstrated stronger performance in organizing information, implementing solution strategies, and evaluating solution accuracy, whereas impulsive students

tended to prioritize response speed over accuracy and completeness. Although some reflective students did not complete all problems, their difficulties were primarily associated with conceptual understanding rather than procedural weaknesses. These results suggest that successful mathematical problem solving is influenced not only by students' mastery of mathematical concepts and formulas but also by the characteristics of their cognitive styles. Therefore, mathematics teachers should consider students' cognitive differences when designing instructional strategies and learning activities. Adaptive instructional approaches that support systematic reasoning, strategic planning, and answer verification may help improve students' problem-solving abilities in the topic of linear equations.

This study has several limitations that should be considered when interpreting the findings. First, the study involved a small number of participants drawn from a single junior high school, which limits the transferability of the results to broader educational contexts. Second, the analysis focused exclusively on reflective and impulsive cognitive styles and on the topic of linear equations; therefore, the findings may not fully represent students' problem-solving behaviors in other mathematical domains or cognitive-style classifications. Future research could involve larger and more diverse samples, examine additional cognitive-style dimensions, and investigate problem-solving processes across different mathematical topics to provide a more comprehensive understanding of the relationship between cognitive style and mathematical problem solving.

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