LOGARITHMA: Journal of Research in Mathematics Education
Vol. 1, No. 1, June 2026, pp. 34–45
DOI: 10.58740/logarithma.v1i1.790
e-ISSN: 3164-1792

Mathematical Reasoning in Solving Linear Equation Problems: A Case Study of Junior High School Students

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ARTICLE INFO

Received:
13 May 2026
Revised:
04 June 2026
Accepted:
08 June 2026
Published:
15 June 2026

KEYWORDS:
Junior High School,
Linear Equation,
Mathematical Reasoning Ability,
Student Ability,
Word Problems.

ABSTRACT

This study aims to describe the mathematical reasoning abilities of students at Bina Utama Junior High School, Pontianak, in solving word problems on the system of linear equations in one variable. The approach used is descriptive qualitative with a case study format. The research subjects consisted of three eighth-grade students selected through purposive sampling technique based on high, medium, and low ability categories. Data collection was carried out through written tests in the form of essay questions and semi-structured interviews. Data analysis refers to the Miles and Huberman interactive analysis model which includes data reduction, data presentation, and conclusion drawing. Data validity was obtained through triangulation techniques. The results show that students' mathematical reasoning abilities vary across categories. High-ability students are able to understand problems and obtain correct answers, but have not yet used systematic solution steps and have not developed formal mathematical models. Medium-ability students show visible progress in reasoning, but still make errors in mathematical modeling and have not verified their answers. Meanwhile, low-ability students have not met the indicators of mathematical reasoning, which is characterized by difficulty understanding problems, developing mathematical models, and drawing logical conclusions. Overall, students' mathematical reasoning abilities still need to be improved through learning that emphasizes mathematical modeling and systematic problem solving.

How to Cite: Saputra, F., Ardiawan, Y., & Irvandi, W. (2026). Analysis of students' mathematical reasoning ability in solving word problems on linear equations in one variable. *LOGARITHMA: Journal of Research in Mathematics Education, X(X), xx–xx.* https://doi.org/10.58740/logarithma.vXiX.pxx-xx

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1. INTRODUCTION

Word problems are a type of problem in mathematics that require solutions using mathematical concepts and procedures (Vessonen et al., 2024). The ability to solve word problems is defined as a student's ability to solve problems related to everyday life presented in the form of mathematical stories (Dyess & Plank, 2024). Through word problems, students are trained to develop reasoning skills, from understanding the problem, designing a solution strategy, to obtaining the correct solution (Fadzil et al., 2025). The ability to solve word problems is inherently connected to mathematical reasoning, as students must not only comprehend the narrative but also translate it into algebraic structures and apply systematic solution strategies.

Mathematical reasoning is a fundamental cognitive process that underlies all mathematical activities, including the ability to identify patterns, make conjectures, provide logical justifications, and draw valid conclusions (Amedu, 2023). Mathematical reasoning skills play a crucial role in solving word problems. Gultom & Saputro, (2022) suggest that good mathematical reasoning is necessary not only to obtain the final answer but also to understand and explain the process involved. However, research by Samosir et al., (2024) indicates that one of the main difficulties experienced by students is understanding the problems in word problems, which is caused by a lack of experience in dealing with contextual mathematics problems. Hasanah et al., (2019) stated that the reasoning process is an integral part of solving various mathematical problems. Ramadhany et al., (2025) concluded that students' mathematical reasoning abilities improved through problem-based learning because students were more frequently involved in problem-solving activities compared to conventional learning.

Prior studies have established that mathematical reasoning is a core competency that must be developed systematically across all educational levels (Nurtamam & Jannah, 2025). Research consistently shows that junior high school students face significant obstacles in translating contextual narratives into formal mathematical representations (Yusnita et al., 2025 & Elsa & Sudihartinih, 2020), partly because learning approaches tend to prioritize procedural memorization over conceptual understanding (Manandhar et al., 2022). Furthermore, reasoning ability cannot develop optimally without consistent engagement with non-routine, contextual problems (Salwa et al., 2025). Prastika et al., (2021) also emphasize that mathematical reasoning is a process of drawing logical conclusions based on relevant facts and rules, and that it is inseparable from mathematical problem solving. Elsa & Sudihartinih., (2020) found that students frequently confuse the relationship between variables and constants when modeling story problems, leading to systematic errors in both formulation and computation.

Despite the growing body of research on mathematical reasoning, most existing studies focus on two-variable linear equation systems or geometry topics, with comparatively little attention given to Linear Equations in One Variable at the junior high school level (Fardian et al., 2024; Hafizah et al., 2025). Furthermore, prior studies have tended to examine mathematical reasoning in high-performing urban schools, leaving a gap in understanding of how students at schools with varying socioeconomic and academic profiles, such as SMP Bina Utama Pontianak, engage with algebraic reasoning tasks. This research is therefore important because it addresses a relatively underexplored topic—word problems—in a real educational context, and because the findings can provide practical guidance for mathematics teachers in West Kalimantan regarding how to differentiate instruction based on students' reasoning profiles.

The contribution of this research to mathematics education is threefold. First, theoretically, it enriches the understanding of how Sumarmo's mathematical reasoning indicators manifest differentially across student ability levels in the context of word problems. Second, practically, it provides teachers with a detailed description of reasoning gaps at each ability level, enabling more targeted and responsive instructional design. Third, methodologically, this study demonstrates the value of combining written diagnostic tests with semi-structured interviews—a triangulation approach that allows for a more nuanced picture of students' actual reasoning processes than test scores alone.

Based on initial observations at SMP Bina Utama Pontianak—including a review of students' previous test papers and an informal interview with the mathematics teacher—it was found that students' mathematical reasoning abilities in solving word problems were still relatively low. Common errors included operating directly on visible numbers without defining variables, omitting solution steps, and failing to verify final answers. Students were unable to identify complete information, were unable to model the problem in the correct mathematical form, and tended to use intuitive methods without considering variables. Based on this explanation, this study aims to describe the mathematical reasoning abilities of SMP Bina Utama Pontianak students in solving word problems and their mathematical reasoning process based on mathematical reasoning indicators according to Sumartini., (2015).

2. METHODS

This research uses a descriptive qualitative research approach with a case study format. Creswell & Creswell, (2017) states that qualitative research focuses on understanding the meaning given by individuals or groups to a social or humanitarian problem. In the context of this research, the primary emphasis is not on obtaining numerical data, but rather on in-depth understanding of students' experiences, ways of thinking, and the meanings they attach to solving word problems.

The research was conducted at SMP Bina Utama Pontianak, located at Jalan H. Rais A. Rachman No. 15A, Sungai Jawi, Pontianak City District, during the even semester of the 2025/2026 academic year. The subjects were 20 eighth-grade students. Subject selection was carried out using purposive sampling, a technique for determining samples based on specific considerations relevant to the research objectives (Campbell et al., 2020). Of the 20 students, three subjects were selected, representing the high, medium, and low ability categories based on the recommendations of their mathematics teachers.

Data collection was conducted using two techniques: a measurement technique in the form of a descriptive diagnostic test and a direct communication technique in the form of semi-structured interviews. The test instrument consisted of three story problems on the material that had been validated by two mathematics education lecturers and one junior high school mathematics teacher. Student scores were classified into three categories: high (80–100%), medium (50–70%), and low (20–40%).

Data analysis referred to the Miles and Huberman interactive analysis model, which includes three stages: data reduction, data presentation, and conclusion drawing and verification (Naeem et al., 2023). Data validity was achieved through technical triangulation, which involved comparing written test data with interview data.

2.1 Research Design

This research uses a descriptive qualitative design with a case study format. The qualitative approach was chosen because the primary emphasis is not on obtaining numerical data, but rather on gaining an in-depth understanding of students' thinking processes and the meanings they attach to solving story problems on the topic of linear equation in one variable. This design allows the researcher to explore the patterns of mathematical reasoning that emerge from students' written test responses and interview transcripts in their natural learning context, without manipulation of variables. The case study format is appropriate because the research focuses on analyzing a specific phenomenon—students' mathematical reasoning ability—in a bounded real-life context (Creswell & Creswell, (2017)

2.2 Participants and Setting

The research was conducted at SMP Bina Utama Pontianak, located at Jalan H. Rais A. Rachman No. 15A, Sungai Jawi, Pontianak City District, during the even semester of the 2025/2026 academic year. A written diagnostic test was administered to 20 eighth-grade students. Of these, three students were selected as focal case-study subjects based on their test scores and teacher recommendations, representing high, medium, and low ability categories: JF (score: 85, High ability), RA (score: 60, Medium ability), and RI (score: 30, Low ability). Subject selection was carried out using purposive sampling, a technique for determining samples based on specific considerations relevant to the research objectives (Campbell et al., 2020). This research was conducted in accordance with applicable research ethics principles, and all participants provided informed consent prior to participation.

2.3 Data Collection and Analysis

2.3.1 Instruments

Data were collected using two techniques: (1) a measurement technique in the form of a descriptive diagnostic essay test, and (2) a direct communication technique in the form of semi-structured interviews. The test instrument consisted of three story problems on material. Essay tests were chosen because they enable the researcher to trace students' step-by-step reasoning processes more clearly than multiple-choice items. The instrument was validated by two mathematics education lecturers from Universitas PGRI Pontianak and one junior high school mathematics teacher. **Table 1** presents the instrument quality analysis results.

Table 1. Instrument Quality Analysis

Item	Difficulty Index (IK)	Discrimination Index	Category
1	0.43 (Moderate)	P = 0.25	Adequate
2	0.43 (Moderate)	P = 0.47	Good
3	0.43 (Moderate)	P = 0.50	Good
Overall Reliability		r = 0.51	Moderate

Note. Validated by two mathematics education lecturers and one junior high school mathematics teacher.

The interview protocol was guided by five indicators derived from Mulyana & Sumarmo. (2015) mathematical reasoning framework: (1) conjecturing, (2) constructing mathematical models, (3) performing mathematical manipulation, (4) drawing logical conclusions, and (5) verifying solution correctness. Student scores were classified into five categories: Very High (80–100%), High (60–79%), Medium (40–59%), Low (21–39%), and Very Low (0–20%). This five-level classification is used consistently throughout the manuscript.

2.3.2 Analysis Procedures

Data analysis followed the interactive analysis model of (Miles et al., 2014), comprising three stages: (1) data reduction—selecting and focusing on data relevant to mathematical reasoning indicators; (2) data presentation—organizing and displaying data in a structured narrative form; and (3) conclusion drawing and verification—formulating conclusions based on the evidence collected. Data validity was ensured through technical triangulation, which involved cross-checking written test responses with interview data from each subject. Student test scores were converted using the formula: N = (score obtained / maximum score) × 100%.

3. RESULTS AND DISCUSSION

From the 20 eighth-grade students who participated in the written test, data were obtained on each student's ability to solve word problems. Based on the results, students were categorized as follows: 6 students (Very High/High ability, score ≥ 60%), 9 students (Medium ability, score 40–59%), and 5 students (Low/Very Low ability, score ≤ 39%). Three subjects were selected for in-depth case analysis: JF (High), RA (Medium), and RI (Low). **Table 2** summarizes the distribution of correct, partially correct, and incorrect responses across the three test items.

Table 2. Distribution of Student Responses on Word Problem Test

Item	Correct	Partially Correct	Incorrect	Description
1	6 (30%)	6 (30%)	8 (40%)	Some students identified known information but made errors in mathematical modeling.
2	5 (25%)	6 (30%)	9 (45%)	Students struggled with mathematical manipulation and systematic procedures.
3	4 (20%)	7 (35%)	9 (45%)	Many students could not draw valid conclusions or select appropriate solution strategies.

Note. n = 20 students

3.1 Diagnostic Test Items (Word Problems)

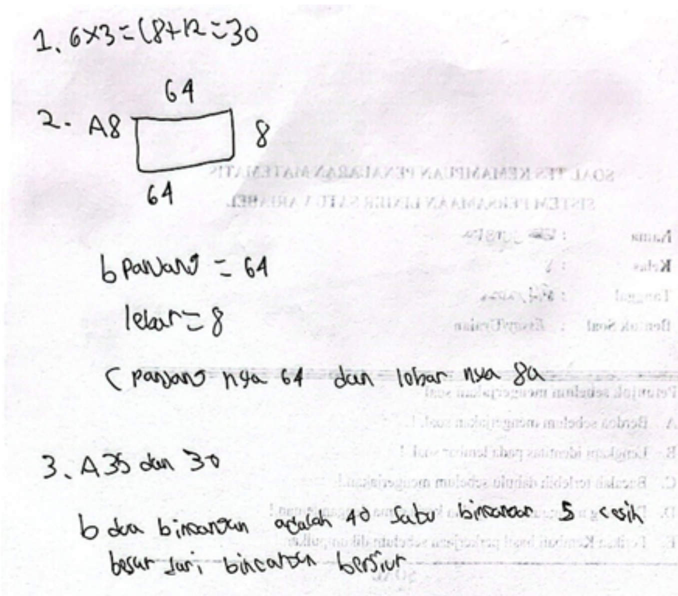
Item 1: A student has a number of marbles. After giving 12 marbles to his friend, the number of marbles the student has is now 3 times the number of marbles his friend had. If his friend initially had 6 marbles, determine the number of marbles the student had before giving the marbles. Write the steps for solving and the conclusion.

Item 2: The perimeter of a rectangle is 64 cm. The length of the rectangle is 8 cm longer than its width. (a) Create a mathematical model of the problem. (b) Determine the length and width of the rectangle. (c) Explain why the answer is correct.

Item 3: The sum of two numbers is 30. One of the numbers is 5 greater than the other. (a) Determine the two numbers. (b) Draw a general conclusion about how to solve problems involving two numbers whose sum and difference are known.

3.1 Mathematical Reasoning of High-Ability Student (Subject JF)

The mathematical reasoning ability demonstrated by high-ability students is represented by Subject JF. The answer provided by Subject JF in solving the mathematical reasoning test can be seen in Figure 1.



1. 6 × 3 = 18 + 12 = 30
2. (Drawing of a rectangle)

   Length = 64
   Width = 8
   The length is 64 and the width is 8
3. 35 and 30
   The difference between the two numbers is 5.
   One number is 5 greater than the other consecutive number.

Figure 1. Written response of Subject JF

Based on **Figure 1**, subject JF categorized as a high-ability student, was able to understand the general context of all three problems and arrived at correct answers on Items 1 and 3. However, on Item 2, JF misidentified the perimeter value (64 cm) as the rectangle's length, resulting in an incorrect mathematical model, though the arithmetic steps were partially correct. JF did not yet use systematic solution steps and had not fully developed a formal mathematical model. In the interview, JF stated that for Item 1 (marbles problem), he immediately calculated without formulating an equation, using mental arithmetic instead of setting up a variable. For Item 3, JF employed a trial-and-error strategy rather than constructing an algebraic equation.

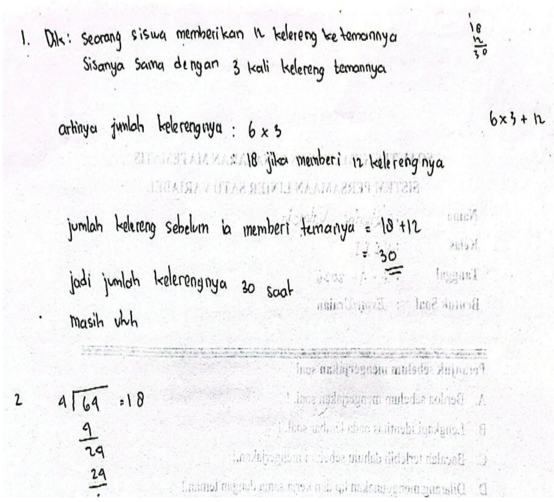
These findings indicate that although JF demonstrated the ability to conjecture and arrive at correct answers, the indicators of constructing mathematical models, performing systematic mathematical manipulation, providing reasoning justification, and verifying solutions were not yet fully met. This is consistent with findings by Fardian et al., (2024), who noted that even high-ability students may focus on obtaining the correct final answer without attending sufficiently to the underlying reasoning process. JF's reliance on intuitive approaches rather than

Vol. 1, No. 1, June 2026, pp. 34–45

formal algebraic modeling suggests that targeted instruction in constructing and using mathematical models is needed even for this ability level.

3.2 Mathematical Reasoning of Medium-Ability Student (Subject RA)

The mathematical reasoning ability demonstrated by medium-ability students is represented by Subject RA. The answer provided by Subject RA in solving the mathematical reasoning test can be seen in Figure 2.



1. Known: A student gives 12 marbles to his friend.
   The remaining marbles are equal to 3 times his friend's marbles.
   This means the number of marbles can be represented as: 6 × 3
   If AR gives 12 marbles, then
   The total number of marbles before giving them to his friend was: 18 + 12 = 30
   Therefore, the total number of marbles was 30 at first.

Figure 2. Written response of Subject RA

Based on **Figure 2**, subject RA categorized as a medium-ability student, showed visible development in mathematical reasoning. RA was able to identify some relevant information from the problem narrative and performed correct arithmetic operations in certain steps. In the interview on Item 1, RA demonstrated an understanding of the problem's context by identifying the known quantities (friend has 6 marbles, 12 were given away) and using multiplication correctly to obtain 18 as an intermediate result before adding back the 12 marbles. When asked whether the answer had been re-checked, RA responded: "No, I didn't check it again." RA did not use a variable or write a formal equation, and did not re-examine the answer after completing the calculation.

These findings reveal that RA partially met the reasoning indicators of conjecturing and drawing conclusions, but did not meet the indicators of constructing a mathematical model, performing systematic mathematical manipulation, or verifying the solution. This is consistent with Hafizah et al., (2025), who found that medium-ability students often understand the problem's general context but fail to translate it into a precise mathematical representation. The absence of algebraic modeling and verification indicates that RA's reasoning is still procedurally incomplete.

3.3 Mathematical Reasoning of Low-Ability Student (Subject RI)

The mathematical reasoning ability of low-ability students was represented by Subject RI. **Figure 3** presents the answer of Subject RI in solving the Mathematical Reasoning test.

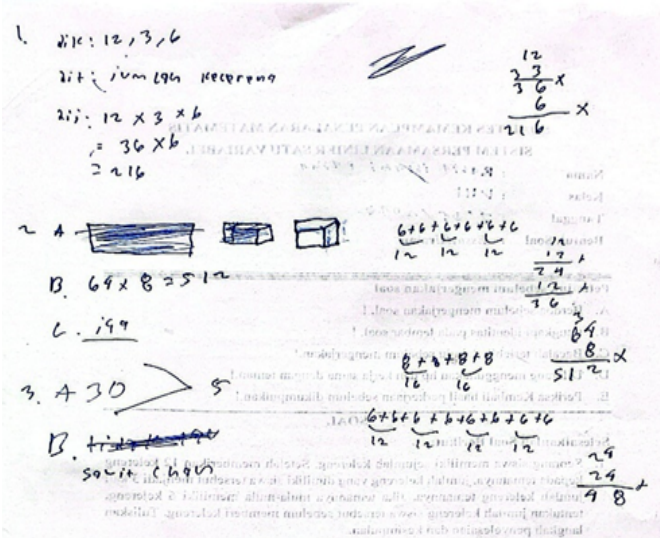


Figure 3 Written response of Subject RI

Based on **Figure 3**, subject RI categorized as a low-ability student, had not yet met any of Mulyana & Sumarmo., (2015) mathematical reasoning indicators. In the interview, RI stated: "I just used the numbers I saw in the problem—12, 3, and 6—but I didn't know how to connect them." RI could not formulate variables or equations, found it difficult to interpret the narrative context into mathematical terms, and did not attempt to verify or draw conclusions from the results. RI acknowledged having learned about mathematical modeling but still did not understand how to apply it. These observations are specific to the three test items administered and should not be generalized beyond this bounded case.

These findings are consistent with those of (Yuni & Suryana, 2020), who emphasized that reasoning ability develops through repeated problem-solving practice, which low-ability students tend to lack. The overall pattern across the three subjects confirms that students' mathematical reasoning abilities are differentiated across ability categories and that all groups require further instructional support in mathematical modeling and systematic problem-solving, as also concluded by Ramadhany et al., (2025) in their systematic literature review on problem-based learning.

3.4 Comparative Analysis Across Ability Categories

A comparative analysis of mathematical reasoning ability across ability categories is presented in **Table 3**. The table illustrates the differences in mathematical reasoning ability among high-ability, medium-ability, and low-ability students based on the results of the Mathematical Reasoning test.

Table 3. Comparison of Mathematical Reasoning Indicators Across Subjects

Sumarmo's Indicator	JF (High)	RA (Medium)	RI (Low)
Conjecturing	✓ Partial	✓ Partial	✗
Constructing mathematical model	✗	✗	✗
Mathematical manipulation	✓ Informal	✓ Partial	✗
Drawing logical conclusions	✓ Partial	✓ Partial	✗
Verifying solution	✗	✗	✗

Note. ✓ = indicator met; ✗ = indicator not met; Partial = partially met.

A cross-category comparison of the three subjects reveals a clear and progressive differentiation in mathematical reasoning ability across the high, medium, and low groups. The most pronounced difference lies in the indicator of constructing mathematical models: Subject JF (high ability) arrived at correct answers through mental arithmetic and trial-and-error but did not construct formal algebraic equations; Subject RA (medium ability) partially understood the problem context and attempted arithmetic operations, yet also failed to formulate a variable-based model; and Subject RI (low ability) was unable to interpret the problem narrative into any form of mathematical representation whatsoever. This finding confirms that mathematical modeling—the translation of real-world contexts into algebraic structures—is the most critical unmet competency across all three ability levels, and represents the primary instructional gap in this school's mathematics learning. In terms of verifying solutions, none of the three subjects demonstrated this behavior—a finding that is notable even for the high-ability subject. This suggests that solution verification is not part of students' habitual problem-solving behavior, regardless of ability level, possibly because it is not emphasized in regular classroom instruction (Prabawanto, 2019).

In terms of conjecturing—the ability to predict or estimate a solution approach—Subject JF demonstrated this indicator most clearly by proposing a solution direction before calculating, even if the method was informal. RA showed partial conjecturing ability on Item 1 but not across all items. RI showed no evidence of conjecturing, instead responding reactively to the numbers present in the text. These contrasts are consistent with the reasoning ability continuum described by Amedu., (2023), and with findings by Prastika et al., (2021), who observed that higher-achieving students demonstrate a broader repertoire of active reasoning strategies, while lower-achieving students tend to rely on surface features of the problem text.

Overall, the findings converge on a shared conclusion: students' mathematical reasoning abilities at SMP Bina Utama Pontianak are underdeveloped relative to the demands of word problems, with the degree of underdevelopment increasing from high to medium to low ability groups. All three subjects share a common weakness in algebraic modeling and solution verification. This differentiated picture underscores the importance of designing mathematics instruction that explicitly scaffolds students' progress through the reasoning indicators—from conjecturing and problem understanding, through mathematical modeling and manipulation, to conclusion-drawing and verification (Elsa & Sudihartinih, 2020; Salwa et al., 2025).

4. CONCLUSION

Based on the research results and discussion, it can be concluded that the mathematical reasoning abilities of students at Bina Utama Pontianak Junior High School in solving word problems on material vary across ability categories. High-ability students are able to understand problems and obtain correct answers, but they do not yet use systematic solution steps, are not optimal in constructing mathematical models, and tend to use trial-and-error strategies. Medium-ability students demonstrate developing mathematical reasoning abilities, but still experience errors in mathematical modeling, do not logically link solution steps, and do not verify their answers. Low-ability students have not yet met the indicators for mathematical reasoning abilities, with primary difficulties in understanding problems, constructing mathematical models, and drawing conclusions.

Overall, students' mathematical reasoning abilities have not yet fully developed, particularly in the aspects of constructing mathematical models, using systematic solution steps, and verifying results. These findings suggest several practical implications for mathematics instruction. First, teachers should explicitly incorporate algebraic modeling activities as a routine component of learning. Second, solution verification should be introduced as a habitual step in problem-solving across all ability levels. Third, differentiated scaffolding is needed: high-ability students benefit from structured modeling practice; medium-ability students require guided transition from arithmetic to algebraic thinking; and low-ability students need foundational support in problem comprehension before progressing to formal representation.

Several limitations of this study should be acknowledged. First, only three subjects (out of 20) were selected for in-depth case analysis, which limits the generalizability of the findings. Second, the study was conducted at a single school in Pontianak, and results may not be representative of other settings. Third, the focus was restricted to a single algebra topic (word problems). Future research is recommended to examine a larger sample across multiple schools and to extend the analysis to other mathematical topicsBased on the research results and discussion, it can be concluded that the mathematical reasoning abilities of students at Bina Utama Pontianak Junior High School in solving word problems on material vary across ability categories. High-ability students are able to understand problems and obtain correct answers, but they do not yet use systematic solution steps, are not optimal in constructing mathematical models, and tend to use trial-and-error strategies. Medium-ability students demonstrate developing mathematical reasoning abilities, but still experience errors in mathematical modeling, do not logically link solution steps, and do not verify their answers. Low-ability students have not yet met the indicators for mathematical reasoning abilities, with primary difficulties in understanding problems, constructing mathematical models, and drawing conclusions.

Overall, students' mathematical reasoning abilities have not yet fully developed, particularly in the aspects of constructing mathematical models, using systematic solution steps, and verifying results. These findings suggest several practical implications for mathematics instruction. First, teachers should explicitly incorporate algebraic modeling activities as a routine component of learning. Second, solution verification should be introduced as a habitual step in problem-solving across all ability levels. Third, differentiated scaffolding is needed: high-ability students benefit from structured modeling practice; medium-ability students require guided transition from arithmetic to algebraic thinking; and low-ability students need foundational support in problem comprehension before progressing to formal representation.

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ACKNOWLEDGMENTS

This research did not receive any specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

DECLARATIONS

Author Contributions: FS: Conceptualization, Writing the Original Draft, Editing, and Visualization; YA: Review and Editing, Formal Analysis, and Methodology; WI: Validation and Supervision; FBAK: Review and Editing, Validation.

Funding Statement: The authors received no financial support for this research.

Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

Amedu, J. Z. (2023). *Examining Mathematics Teachers' Perceptions of The Effects of Informal Learning on Teacher Knowledge and Practices: An Explanatory, Sequential Mixed-Methods Study*. North Carolina State University.

Campbell, S., Greenwood, M., Prior, S., Shearer, T., Walkem, K., Young, S., Bywaters, D., & Walker, K. (2020). Purposive sampling: complex or simple? Research case examples. *Journal of Research in Nursing*, *25*(8), 652–661.

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.

Dyess, S. R., & Plank, C. (2024). Using the Numberless Math Stories Routine to Support Young Learners' Problem-Solving Strategies. *YC Young Children*, *79*(2), 68–75.

Elsa, H. A., & Sudihartinih, E. (2020). Error analysis of high school students on linear program topics based on newman error analysis. *Mathematics Education Journal*, *4*(1), 7.

Fadzil, N. M., Osman, S., Ahmad, J., Jambari, H., & Husain, S. K. S. (2025). Enhancing students' problem-solving skills in algebra word problems: A systematic review of TAPPS and storyboarding strategies. *International Electronic Journal of Mathematics Education*, *20*(4), em0850.

Fardian, D., Suryadi, D., & Prabawanto, S. (2024). Students' learning obstacles in solving mathematical proficiency tasks: A hermeneutic phenomenological study focused on Algebra. *Kreano, Jurnal Matematika Kreatif-Inovatif*, *15*(2), 593–618.

Gultom, C. I., & Saputro, D. R. S. (2022). Students' mathematical reasoning skills in solving mathematical problems. *JPI (Jurnal Pendidikan Indonesia)*, *11*(3), 542–551.

Hafizah, N., Nurhalimah, S., Utami, W. L., & Angraini, L. M. (2025). Analysis of Problem-Solving Ability of Junior High School Students in A System of Linear Equations With One Variable. *International Journal of Contemporary Studies in Education (IJ-CSE)*, *4*(1), 1–14. https://doi.org/10.56855/ijcse.v4i1.1046

Hasanah, S. I., Tafrilyanto, C. F., & Aini, Y. (2019). Mathematical Reasoning: The characteristics of students' mathematical abilities in problem solving. *Journal of Physics: Conference Series*, *1188*(1), 012057.

Manandhar, N. K., Pant, B. P., & Dawadi, S. D. (2022). Conceptual and procedural knowledge of students of Nepal in algebra: A mixed method study. *Contemporary Mathematics and Science Education*, *3*(1), 1–10.

Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative data analysis*. sage.

Mulyana, A., & Sumarmo, U. (2015). Meningkatkan kemampuan penalaran matematik dan kemandirian belajar siswa SMP melalui pembelajaran berbasis masalah. *Didaktik*, *9*(1), 40–51.

Naeem, M., Ozuem, W., Howell, K., & Ranfagni, S. (2023). A step-by-step process of thematic analysis to develop a conceptual model in qualitative research. *International Journal of Qualitative Methods*, *22*, 16094069231205788.

Nurtamam, M. E., & Jannah, A. N. (2025). A systematic qualitative review of teachers' strategies in enhancing mathematical reasoning in elementary schools. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, *9*(2), 553–562.

Prabawanto, S. (2019). Students' validations on their solution in mathematical problem solving. *Journal of Physics: Conference Series*, *1157*(4), 042111.

Prastika, V. Y. A., Riyadi, & Siswanto. (2021). Mathematical reasoning ability of junior high school viewed from logical mathematical intelligence. *Journal of Physics: Conference Series*, *1918*(4), 042067.

Ramadhany, N., Tampa, A., & Upu, H. (2025). Systematic Literature Review: The Effectiveness Of Using The Problem-Based Learning Model In Improving Problem-Solving Skills. *Mathline : Jurnal Matematika Dan Pendidikan Matematika*, *10*(3), 703–720. https://doi.org/10.31943/mathline.v10i3.859

Salwa, S., Hidayah, N., & Aribuabo, A. F. M. (2025). An Analysis Of Eleventh-Grade Students' Mathematical Problem-Solving Abilities In Contextual Circle Problems. *Mathline: Jurnal Matematika Dan Pendidikan Matematika*, *10*(3), 801–816.

Samosir, C. M., Herman, T., Prabawanto, S., Melani, R., & Mefiana, S. A. (2024). Students' difficulty in understanding problems in the contextual problem-solving process. *Prisma*, *13*(1), 20.

Sumartini, T. S. (2015). Peningkatan kemampuan penalaran matematis siswa melalui pembelajaran berbasis masalah. *Mosharafa*, *4*(1), 1–10.

Vessonen, T., Dahlberg, M., Hellstrand, H., Widlund, A., Korhonen, J., Aunio, P., & Laine, A. (2024). Task characteristics associated with mathematical word problem-solving performance among elementary school-aged children: A systematic review and meta-analysis. *Educational Psychology Review*, *36*(4), 117.

Yuni, Y., & Suryana, A. (2020). Open-Ended Problems for Junior High School Studentsâ€™ Mathematical Reasoning. *IndoMath: Indonesia Mathematics Education*, *3*(2), 88–99.

Yusnita, I., Sumarmo, U., & Fitriani, N. (2025). Exploratory Data Analysis on Mathematics Learning Difficulties for Junior High School Students/MTs on Solving Story Problems in Terms of Gender. *(JIML) JOURNAL OF INNOVATIVE MATHEMATICS LEARNING*, *8*(1), 100–112.