

Analysis Capabilities Understanding Mathematics Students MTsN 1 Probolinggo on Algebraic Shape Calculation Operation Material

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ABSTRACT

This research is motivated by the low ability of students' mathematical understanding of algebraic form calculation operations. Students tend to have difficulty understanding concepts, identifying elements of algebraic forms, and applying these concepts in problem solving. This study aims to describe the mathematical comprehension ability of grade VII MTsN 1 Probolinggo students in algebraic form calculation operation material. This study uses a qualitative approach with a descriptive type of research. The subjects of this study were 21 students in grade VII MTsN 1 Probolinggo, of which 6 students were selected as in-depth interview subjects based on the categories of cognitive ability (high, medium, and low). Data collection was carried out through a description test consisting of seven questions based on seven indicators of mathematical comprehension ability and strengthened by semi-structured interviews. The results of the study show that the mathematical comprehension ability of grade VII MTsN 1 Probolinggo students in the operation material calculating algebraic forms is quite good, but it is not evenly distributed in all indicators. High-category students were able to master almost all indicators well, although they were slightly constrained in explaining conceptual meaning in a contextual manner. Middle-category students have mastered basic concepts and identification of like-minded syllables, but encounter obstacles when constructing complex mathematical models and simplifying algebraic fractions. Meanwhile, the complex. Meanwhile, students in the lower group still experience fundamental obstacles in mastering concepts, differentiating same-sex tribes, and working on procedures.

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1. INTRODUCTION

Education basically aims to shape students to have an intelligent, critical, and strong character mindset (Rosita, 2018). In the world of education, mathematics is often This is considered one of the most essential lessons because it trains individuals to think logically, systematically, analytically, and creatively in dealing with various problems (Pradana, 2020). In order for students to understand and

master mathematics learning effectively, students should not just calculate numbers mechanically, but need the main foundation in learning, namely solid mathematical comprehension skills.

Mathematical comprehension skills are one of the essential skills that every student must have. This is because a strong understanding of mathematics can enrich students' mathematical knowledge in a sustainable manner (Rachmawati et al., 2021). Thus, students do not only memorize procedures or calculation formulas, but master the basic concepts and are able to apply them in various problem contexts. Students with a good understanding can reinterpret the material using their own simple language. Conversely, low mathematical understanding causes students to only focus on memorizing algorithms without understanding the core of the concept. As a result, students often have difficulties when dealing with algebraic material that demands an in-depth understanding of symbols, variables, coefficients, constants, and algebraic form operations.

Algebraic form calculation operation material is a basic topic that is often considered difficult by students at the Junior High School / Madrasah Tsanawiyah level. This difficulty arises due to the abstract nature of algebra, which requires students to think abstractly to understand symbols, recognize the elements of algebraic forms, and perform addition, subtraction, multiplication, and division operations correctly. Students often make mistakes in simplifying algebraic forms, grouping similar syllables, or applying these operations to contextual problems. The inability to represent algebraic concepts is a sign that students' mathematical understanding has not reached the desired standard.

These findings are reinforced by research Mulyani et al., (2018), which states that students' mathematical comprehension ability in algebraic form material is still relatively low. The results of the study revealed that students had difficulty applying formulas to simple calculations, performing algorithmic calculations, and connecting 1 concept with other concepts in the form of algebra. In line with that, Alfina & Sutirna, (2022) It was found that students' mathematical comprehension ability in algebra material was not optimal, especially in the indicators of building necessary and sufficient conditions, as well as applying concepts or algorithms to solve problems.

Based on this background, this study aims to examine and describe in detail the mathematical comprehension ability of grade VII MTsN 1 Probolinggo students in the material of algebraic form calculation operations based on indicators of mathematical understanding. This in-depth analysis is expected to provide a clear picture of the indicators that have been mastered and that still need to be improved in mathematics learning.

2. METHODS

This study uses a qualitative approach with a descriptive type of research. The descriptive qualitative method aims to relate and describe systematically and deeply the phenomenon being studied in accordance with real conditions in the field without providing special intervention or treatment to the research subject (Waruwu, 2024).

The research was carried out at MTsN 1 Probolinggo with the research subjects consisting of 21 grade VII students. Data collection was carried out through two main instruments, namely a written test in the form of 7 description questions representing 7 indicators of mathematical comprehension ability and semi-structured interview guidelines. The test instruments and interview guidelines have been declared valid by two validators (mathematics education lecturer at Nurul Jadid University and subject teachers mathematics MTsN 1 Probolinggo) with a validity score of 3.375 (test questions) and 3.57 (interview guidelines, respectively), which meet the valid criteria ($3 < N \leq 4$).

The grouping of students' cognitive ability levels is determined based on the average score ($\bar{x}$) and standard deviation (SD) with the following criteria:

1. High Category: Value $\geq \bar{x} + SD$ (Value ≥ 71.92)

2. Medium Category: $\bar{x} - \text{Elementary} < \text{Score} < \bar{x} + \text{SD}$ ($27.98 < \text{Score} < 71.92$)

3. Low Category: $\text{Value} \leq \bar{x} - \text{SD}$ ($\text{Value} \leq 27.98$)

From 21 students, 6 representative subjects were selected for in-depth interviews, namely 2 high category subjects (ST1 and ST2), 2 medium category subjects (SS1 and SS2), and 2 low category subjects (SR1 and SR2).

3. RESULTS AND DISCUSSION

3.1. Instrument Validation Results

Before the instrument is used in research, a validity test is carried out by experts. The results of the recapitulation of test question validation and interview guidelines are presented in Table 1 and Table 2.

Table 1. Instrument Validation Results for Test Questions

Validator	Total score	Multiple Indicators	Validity value (N)	Categories
Mathematics Lecturer (Validator 1)	27	8	3, 375	Valid
Math Teacher (Validator 2)	27	8	3, 375	Valid

Table 2. Results of Student

Validator	Total score	Multiple Indicators	Validity value (N)	Categories
Mathematics Lecturer (Validator 1)	25	7	3, 57	Valid
Mathematics Teacher (Validator 2)	25	7	3, 57	Valid

The implementation of the test was given to 21 grade VII students. The results of the statistical calculation showed the mean value of $\bar{x} = 49.95$ and the Standard Deviation (SD) = 21.97. The grouping of students' cognitive limits is determined as follows:

High Group (Value ≥ 71.92): 4 Medium Group students ($27.98 < \text{Value} < 71.92$): 12 students Low Group (Value ≤ 27.98) : 5 students

3.2. Exposure to Job Data and Research Subject Interviews

Based on the cognitive group above, 6 research subjects were selected to conduct in-depth interviews, namely ST1 (GKZP), ST2 (MCP), SS1 (KAS), SS2 (DAS), SR1 (AKW), and SR2 (AARR).

1. High category subjects (ST1 and ST2)

The ST1 subject (GKZP) obtained a score of 78. Based on written tests and interviews, ST1 is able to convert story problems into algebraic form, determine variables, coefficients, and constants precisely,

and identify similar syllables based on their variables and ranks. The following are the results of the interview conducted by the researcher with ST1:

Q: Look at your answer number 1a, how do you turn the story into an algebraic form?

ST1 : Right 1 pencil box is x, because Nadia bought 3 pencil boxes then I write $3x$, then 1 eraser is y, because 5 erasers I write $5y$. So the algebraic form is $3x + 5y + 2000$, well 2000 is the cost of packaging.

Q: How do you define variables, coefficients, and constants?

ST1: The variables are x and y, the coefficients are 3 and 5 because they are in front of the letter, while 2,000 is a constant because it has no variables.

ST2 (MCP) also obtained a score of 78 and showed excellent mathematical understanding of most indicators. ST2 smoothly performs factoring operations on the numerator to simplify algebraic fractions and is able to distinguish simplified and non-simplified algebraic forms based on the similarity of their variables.

2. Medium Category Subjects (SS1 and SS2)

SS1 (KAS) subjects obtained a score of 69 and SS2 (DAS) obtained a score of 66. Medium category subjects have mastered basic indicators such as defining variables, coefficients, and constants and classifying simple similar terms. However, they still experience confusion in complex algebraic form factoring operations as well as in the formulation of mathematical models that involve multiple operations at once.

3. Low Category Subjects (SR1 and SR2)

Subjects SR1 (AKW) obtained a score of 25 and SR2 (AARR) obtained a score of 13. The low-category subjects (SR1 and SR2) experienced significant obstacles in understanding the concept of algebraic form calculation operations. SR1 and SR2 are only able to answer Questions 1a and 2 in a limited way. In Questions 3 to Question 7, most of the answer sheets are blank. Based on the interview, the subject admitted that he did not

Understanding the meaning of the story, confused about determining the first step of completion, and not knowing how to simplify algebraic fractions or distributive properties. This condition strengthens the research Putri et al. (2018) that low-ability students experience major obstacles to problem representation and model preparation that low-ability students experience major obstacles to problem representation and mathematical model preparation.

Overall, the results of the analysis showed that the mathematical comprehension ability of MTsN 1 Probolinggo students in the algebraic form calculation operation material varied sharply between cognitive groups. Based on NCTM's 7 indicators of mathematical comprehension:

1. **Define concepts verbally and in writing:** Being in the category of good for high and medium groups, but low groups are still often confused between the definition of variables and coefficients.
2. **Identify examples and non-examples:** High and medium groups can precisely distinguish between similar and non-similar tribes, while low groups sometimes ignore variable ranks.
3. **Using models, diagrams, and symbols:** Most students can use variable symbols (x, y), but the creation of complex story models is still a barrier for medium and low groups.
4. **Converting one form of representation to another:** The ability to convert verbal sentences into algebraic models is quite good in high groups.
5. **Getting to know various meanings and interpretations of concepts:** Students still tend to have difficulty contextually interpreting the meaning of variables or constants of calculation results.
6. **Identifying the properties of a concept:** Factoring and simplification of the new form of

algebraic fractions is predominantly dominated by the high group.

7. **Comparing and contrasting concepts:** High groups are able to analyze the reason the algebraic form P can be simplified while the form Q is not.

These results are in line with the findings Takalao et al. (2023) and Praja et al. (2021) which emphasizes the need to emphasize the basic concepts of algebra visually and concretely so that students do not only memorize the operation procedures of algebra.

4. CONCLUSION

Based on the results of data analysis and discussion, it can be concluded that the mathematical comprehension ability of grade VII MTsN 1 Probolinggo students in the algebraic form calculation operation material is generally quite good, but not evenly distributed in every indicator. High group students were able to master all indicators well, group students were mastering basic indicators but still experienced difficulties in factoring and compiling complex contextual models, while low group students still experienced serious obstacles in mastering basic concepts and rules of operation of similar tribes. Therefore, mathematics teachers are advised to place more emphasis on abstract algebraic concepts using concrete media or contextual approaches so that middle and low group students are not trapped in memorizing formulas, and for future researchers, interactive media-based learning interventions can be developed to overcome students' specific difficulties in algebraic materials.

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