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# Analysis of Junior High School Students' Understanding in Determining the Sequence of Integers

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**ABSTRACT**

This study intends to analyze students' ability to determine the order of positive and negative integers and to identify the difficulties they experience in understanding the concept. The subject matter is important because many students still experience confusion in comparing and ordering integers, especially when negative numbers are involved. This type of research uses a qualitative-descriptive approach. This study was conducted in grade VI of a public junior high school 13, Jember, with 32 students selected based on the willingness of the school and teachers, but only 6 students who met the criteria were selected. The instruments used included a written test and in-depth interviews. The results showed that students' understanding of the ordering of positive and negative integers is relatively low. Students often face challenges in distinguishing and ordering positive and negative numbers, especially when dealing with number lines or mixed operations. The main factor contributing to students' challenges is a lack of understanding of the basic concepts of integers and their application on the number line. Students sometimes experience confusion regarding the order of numbers due to their incomplete understanding of numerical positions on the number line, as well as the principle of absolute value and the meaning of positive and negative signs. The results of this study are expected to provide a general overview of students' level of understanding and provide recommendations for effective learning strategies to improve their ability to correctly order integers.



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## 1. INTRODUCTION

Understanding the concept of integers, particularly how to order positive and negative integers, is a crucial component of mathematics learning in elementary and secondary schools (Bryant et al., 2020; Lin et al., 2021). Integers, which consist of positive, zero, and negative numbers, have characteristics and operate differently from all other numerical values. However, many students struggle to grasp this concept in real-life situations. This is especially true for ordering integers that consist of both positive and negative numbers. Students often experience this difficulty because they

are unable to correctly apply the concept of integers to a number line (Barbieri et al., 2020; Alfarisi et al., 2022). As a result, they are confused about determining the correct order of numbers (Yunita & Pratiwi, 2022).

Analysis of student understanding shows that most students do not fully grasp the basic concepts of integers, including the definition of integers themselves and the rules for arithmetic operations involving positive and negative signs (Aduko & Armah, 2022; Harun et al., 2023). For example, students often misinterpret negative and positive signs, leading to errors in ordering and operations with integers. Some students also experience confusion when faced with problems that combine positive and negative numbers in a single problem, especially if there are parentheses and mixed operations such as addition and subtraction of negative numbers (Fuadiah & Suryadi, 2017).

Understanding mathematical concepts in general is an important skill that students must possess to think logically, analytically, systematically, and critically in solving mathematical problems (Wong, 2021; Sulistyowati et al., 2023; Cai & Rott, 2024). This conceptual understanding is the result of students' thinking activities in comprehending and internalizing the concepts taught, enabling them to explain them in their own words and apply them to various problem contexts (Bostan Sarioglan & Kucukozer, 2017; Nachowitz, 2018; Giriansyah et al., 2023). Effective mathematics learning must equip students with these skills so that they not only memorize formulas but also understand the meaning and application of mathematical concepts in depth (Yulianty, 2019; Schoenfeld, 2022).

Mathematics itself is the study of patterns, structures, shapes, and relationships between abstract objects using logical methods and systematic proof (Assmus & Fritzlar, 2022). Mathematics functions not only as a pure science that develops theories and concepts but also as a tool in various fields of science and everyday life (Michelsen, 2006; Wigderson, 2019; Schukajlow et al., 2025). In an educational context, mathematics is defined as a science structured in a hierarchical and logical manner, aimed at developing students' thinking skills so they can understand concepts, reason, and solve problems effectively (Yulianty, 2019; Koerfer et al., 2025).

Therefore, students' understanding of mathematics, particularly the topic of integers and their ordering, is crucial for their success in further mathematics studies. The difficulties students experience in understanding the concept of integers demonstrate the need for a more contextual and realistic learning approach, such as a realistic mathematics learning approach, which has been shown to significantly improve students' understanding of mathematical concepts compared to conventional learning (Sipayung & Anzelina, 2019; Sari, 2021). Student understanding is the ability to understand, interpret, and apply concepts or material learned correctly and in depth (Kholid et al., 2021). In this context, student understanding refers to their ability to correctly recognize, compare, and order positive and negative integers.

Students' understanding of ordering positive and negative integers still faces challenges, particularly in understanding the concept of negative values and their application on a number line (Fuadiah & Suryadi, 2017). This difficulty can be overcome by using concrete learning media such as number lines and more interactive

and demonstrated methods. This approach helps students visualize the position of numbers and better understand the order of integers, thereby improving their ability to correctly order integers (Bernati et al., 2018).

Based on the previous description and conception, this study aims to analyze students' abilities in determining the order of positive and negative integers and identify the difficulties experienced by students in understanding this concept.

## 2. METHOD

This study uses a descriptive qualitative approach, which aims to describe in depth the students' ability to order integers and the difficulties they face. The study was conducted in class VI of public junior high school 13 Jember, with 32 students selected based on the willingness of the school and teacher, but we only selected 6 students who met the criteria. The following is a descriptive qualitative approach presented in Figure 1.

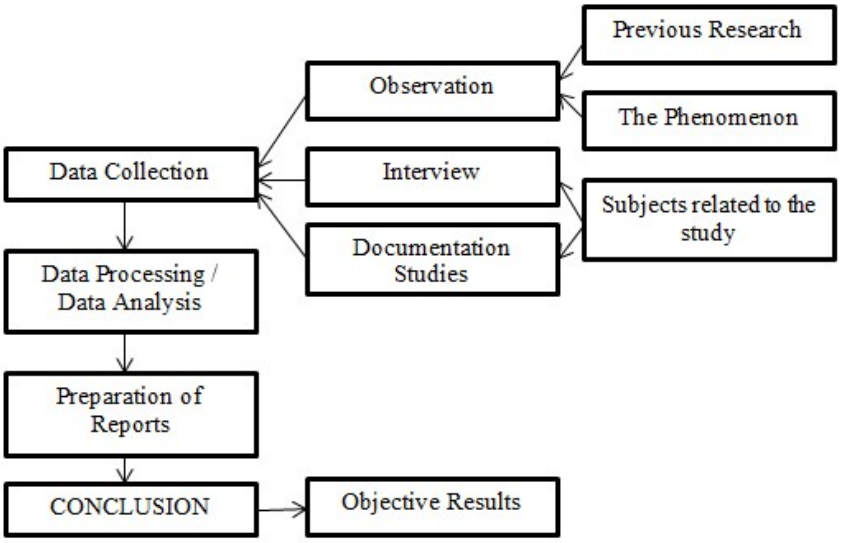


**Figure 1**. Descriptive Qualitative Approach

Data collection was conducted through three main techniques:

1. Written tests, to measure students' basic ability to order positive and negative integers, using a number line as a visual aid.

2. In-depth interviews to explore students' conceptual understanding, thinking strategies, and the challenges they encountered when solving problems.

3. Case studies, to analyze more specifically several students representing high, medium, and low ability levels.

The data obtained will be analyzed descriptively, with an emphasis on students' thought processes and difficulty patterns. The results of this analysis will form the basis for formulating more effective learning recommendations that are tailored to student characteristics in the field.

## 3. RESULTS AND DISCUSSION

### Results

Based on research conducted at Public Junior High School 13 Jember, it was found that students' understanding of ordering positive and negative integers still faces various challenges. Observations, written tests, and interviews revealed that:

1. Most students do not fully understand the basic concepts of integers, especially in distinguishing between positive and negative numbers and ordering them on a number line.
2. Students often misinterpret positive and negative signs, resulting in errors in determining the order of numbers.
3. Difficulty increases when problems involve mixed operations or integer results presented in the form of word problems. Only a small proportion of students can order integers correctly and consistently, especially those who are active and highly motivated to learn.

Based on data analysis, students' level of understanding can be grouped into three categories:

1. High: Students can correctly order positive and negative integers, understand the number line, and explain their reasoning.
2. Moderate: Students understand the basic concepts but are still unsure or make mistakes when problems are more complex, especially those involving negative numbers.
3. Low: Students often confuse positive and negative numbers, do not understand the number line, and often make mistakes when ordering numbers.

This study was conducted to analyze the level of students' understanding in ordering positive and negative integers at junior high school. Based on test results and score grouping, students were divided into three categories: high, medium, and low. The following is a summary of the student scores in Table 1.

**Table 1.** Summary of Student Grade Results

| Category | Student Name | Value |
|---|---|---|
| High | AM | 88 |
| | AR | 87 |
| Medium | AMP | 52 |
| | MF | 60 |
| Low | DAS | 45 |
| | MPO | 30 |

### Analysis of High Category Student Understanding

Students in the high category, such as AM (88) and AR (87), demonstrated excellent understanding of ordering positive and negative integers. They were able to grasp the concept of the number line well, quickly distinguish between positive and negative numbers, correctly order integers from smallest to largest or vice versa, and apply integer concepts in various problem contexts.

Students in this category possessed strong conceptual understanding, not only memorizing rules but also understanding the rationale behind them. They were active in learning and highly motivated.

**Analysis of Student Understanding in the Medium Category**

Students in the moderate category, such as AP (52) and MA (60), demonstrated a good understanding but still experienced some difficulties, particularly:

1. They occasionally struggle to define negative numbers.
2. Understand the basic concept of integers but sometimes make mistakes in applying them.
3. Require visual aids such as number lines to solve more complex problems.

Students in this category require additional practice and guidance, especially for problems involving mixed operations or negative numbers with varying values.

**Analysis of Student Understanding in the Low Category**

Students in the low category, such as MPO (30) and DM (45), experienced significant difficulties in:

1. Understanding the basic concept of integers
2. Differentiating between positive and negative integers
3. Determining the order of numbers on a number line
4. Applying the concept of non-integers in solving problems

These difficulties were caused by several factors, including:

1. Lack of understanding of the basic concept of integers
2. Not understanding the function of the number line as a tool
3. Difficulty interpreting negative and positive signs
4. Low motivation to learn

**Factors Influencing Student Understanding**

Based on the analysis of research results, several factors influence students' understanding of ordering positive and negative integers, including:

1) Learning Method

The use of demonstration methods and visual aids has proven to be more effective than traditional lecture methods.

2) Learning Media

Students who learn with the aid of visual aids such as number lines demonstrate better understanding.

3) Motivation and Interest in Learning

Students who are effective and motivated tend to have a better understanding of concepts.

4) Learning Environment

Support from teachers, family, and the availability of learning media also influence student learning outcomes.

**Understanding Enhancement Strategy**

To improve students' understanding of ordering positive and negative integers, several strategies can be implemented, including:

1) Use of Concrete Media: Use number lines and other visual aids to visualize the concept of integers.

2) Contextual Approach: Relate the concept of integers to real-life situations.

3) Demonstration Method: Use more interactive and demonstrative learning methods.

4) Varied Practice Questions: Provide practice questions with varying levels of difficulty to reinforce conceptual understanding.

This research recommends that teachers use more innovative and contextual learning methods and increase the use of teaching aids and visual media in mathematics. This is expected to improve students' ability to understand and correctly order positive and negative integers.

## 4. CONCLUSION

The conclusion of this research is students' understanding of ordering positive and negative integers at Public Junior High School 13 Jember; it can be concluded that students' understanding of ordering positive and negative integers is still moderate to low. Students often have trouble distinguishing and ordering positive and negative numbers, especially when faced with problems involving number lines or mixed operations. The main factor contributing to students' difficulties is a lack of understanding of the basic concepts of integers and their application on the number line. Students tend to be confused about determining the order of numbers because they do not yet fully understand the position of numbers on the number line, as well as the concepts of absolute value and positive-negative signs. Effective learning strategies to improve student understanding include the use of concrete media such as number lines and interactive learning methods. Students can better visualize the position and order of integers through a contextual approach, demonstrations, and varied practice problems.

Therefore, the results of this study are expected to serve as a reference for educators and schools in designing more effective mathematics learning methods, particularly for integers, thereby improving student understanding and achievement.

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