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ANALYSIS OF PRIMARY SCHOOL STUDENTS' MATHEMATICAL CONCEPTUAL UNDERSTANDING BASED ON LEARNING INTEREST

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ABSTRACT

This research utilized a qualitative approach to providing a descriptive and in-depth exploration of elementary school students' mathematical and conceptual understanding of their learning interests. The study includes 20 participants, selected based on the categories of their learning interests, with three representatives chosen from each category. Participants are also selected based on their age, according to Piaget's theory, and communication abilities. Data collection techniques involve data reduction, data categorization, and data verification. Based on the research findings and discussions, it can be concluded that students with high learning interests demonstrate a strong understanding of mathematical concepts. Similarly, students with moderate learning interest exhibit a commendable grasp of mathematical concepts, while students with low learning interest tend to have lower conceptual understanding. For future research, it is recommended to explore the use of instructional media to assess children's learning interests.

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INTRODUCTION

Education is expected to give students a deeper understanding of mathematics (Nopriana, 2017). Mathematics is taught across all levels of education (Fajri, Yurniawati, & Utomo, 2019). In the curriculum, the goal of mathematics education includes comprehension of mathematical concepts. Indicators of conceptual understanding include (a) restating a concept, (b) presenting mathematical situations in various ways and recognizing their differences and similarities, (c) classifying objects based on the criteria that form the concept, (d) applying the relationship between concepts and procedures, (e) providing examples and non-examples of the learned concept, (f) applying concepts algorithmically, and (g) developing the learned concepts (Hajar & Sari, 2018).

One of the challenges in mathematics education is the students' struggle with conceptual understanding. Inadequate comprehension of concepts can harm the learning process and outcomes (Rahman, Gusriani, & Arriah, 2022). The observational results reveal that students' understanding of concepts remains low, aligning with the findings of Rahman et al. (2022), who highlighted that students' difficulties in solving math problems stem from their conceptual understanding. Primary school is the foundation for students to grasp mathematical concepts, significantly influencing their subsequent education (Sari, 2017).

In the case of third-grade students at the school under investigation in this research, challenges arose in conceptual understanding when tackling addition problems within a contextual framework. Drawing from Jean Piaget's theory of cognitive development, children aged 7 to 11 exhibit individual differences in behavior, leading to disparities among learners. Those who struggle with proper learning are identified as experiencing learning difficulties (Ghufron & Risnawita, 2015). Equivalent to elementary school students, they are situated in the concrete operational stage, wherein concrete operational thinking involves operations. The ensuing explanation elucidates the conceptual understanding of elementary school students when solving story problems focused on addition. Figure 1 illustrates the outcome of one student's response during a classroom problem-solving activity.

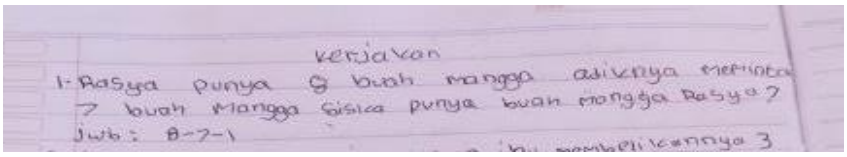

Figure 1. Student's Response Result

Figure 1 illustrates that the student struggled to grasp the mathematical concept. The student could not articulate what was being asked and provided answers without understanding the process of solving the problem. In the figure, the student responds without demonstrating the steps taken to reach the solution. The subsequent section presents the results of student interviews.

p : Do you understand this problem?
S : Yes.
p : How do you solve the problem?
S : The numbers on the question.
p : How to calculate it?
S : I don't know.

Based on interviews with the student, it was found that the student could not explain the given problem and simply provided an answer based solely on the numbers in the problem. The student has not yet developed the ability to analyze the problem and, as a result, provides answers without fully understanding the context of the question.

One of the factors contributing to the lack of conceptual understanding is the student's learning interest (Novitasari, 2016). A lack of interest in learning causes students to pay less attention to the material, eventually leading to a lack of understanding of the concepts. Sometimes, students may memorize formulas or concepts without truly comprehending them. Consequently, they cannot apply these concepts in different situations (Komariyah, Afifah, & Resbiantoro, 2018).

Based on the facts above, the problem in this research is the low level of mathematical conceptual understanding among primary school students. The results of documentation analysis and interviews indicate that students struggle to understand the concept of fractions in the given story problems. As a result, students may provide answers without fully grasping the concept of fraction addition they are working on. Therefore, this research aims to analyze the level of conceptual understanding in relation to learning interest among Year 3 students at one of the primary schools in Langgengsari, Indonesia. The aspiration is that through comprehending these factors, students' future mathematical and conceptual understanding will witness significant improvement.

METHOD

This research employed a qualitative approach. The research design is a case study that

involves an in-depth investigation of individuals within a specific time frame, aiming to describe and gain a deep understanding of a particular entity. The analysis employs a realistic-based take and give learning model to enhance students' conceptual understanding of their learning interests. The research was conducted on 20 Year 3 students from one of the primary schools in Langgengsari, Indonesia. The instruments in this study were a test of fraction operation and interview guidelines. The indicators for the concept comprehension ability used in this study are shown in Table 1.

Table 1 Concept Comprehension Indicators

Indicators	Explanation
Ability to rephrase" or "ability to restate.	Able to verbally explain the concepts they have learned.
Ability to clarify" or "ability to provide clarification.	Ability to apply the relationship between concepts and procedures.
Flexible ability.	Ability to present mathematical situations in various ways and recognize their differences and similarities.

In determining the subjects, the researchers used a purposive sampling technique based on the criteria of high, medium, and low student interest in learning. The indicators of learning interest, categorized into three groups, were adapted from Nurhasanah and Sobandi (2016), as seen in Table 2.

Table 2 Students' Learning Interest Indicators

Category	Capability
High	If someone desires an object of interest within a specific time frame.
Medium	someone wants an object but not in short-term memory.
Low	If someone does not desire an object of interest.

This research involves 20 subjects. Based on the categories of students' learning interests, three participants were selected to represent each category. Subject S1 represents those with high learning interest, subject S2 represents those with moderate learning interest, and subject S3 represents those with low learning interest. Additionally, the sample was chosen based on the age of the children, following Jean Piaget's theory (Marinda, 2020; Saraswati & Agustika, 2020), as Year 3 students (around 9 years old) are in the concrete operational stage. The sample selection also considered communication ability, as it is an important factor in this research, where communication ability refers to a person's capability to communicate ideas using symbols, tables, diagrams, or other media to clarify issues (W, Rosita, Pramuditya, Didaktis, & Matematis, 2019). Therefore, communication ability is a crucial aspect in determining the research sample. Data collection techniques used in this study included data gathering, reduction, display, and verification (Creswell, 2015).

RESULT AND DISCUSSION

Based on the observation results, the subjects were categorized into three levels of learning interest (Figure 2).

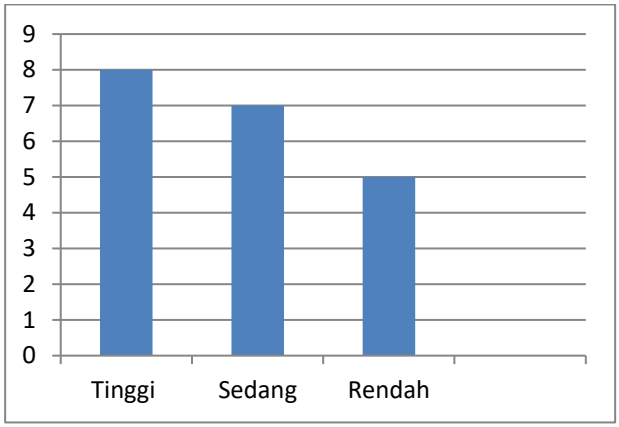

Figure 2: Students' Learning Interest

Figure 2 shows eight subjects in the high learning interest category, seven in the moderate learning interest category, and five in the low learning interest category. From the 20 subjects, one subject was selected from each learning interest category, considering their age and mathematical communication ability. Further analysis was conducted based on learning outcomes and in-depth interviews with the subjects to gain deeper insights into their conceptual comprehension abilities. The results of the study, based on the concept comprehension indicators, are presented as follows.

Subject with High Learning Interest (S1)

Based on the problem-solving results, it can be said that subject S1 can solve problems effectively and meet the concept comprehension indicators. Subject S1 actively participated, paid attention, and engaged well during the learning process. Additionally, subject S1 was able to provide learning inputs to the class. Figure 1 shows the learning outcomes of subject S1.

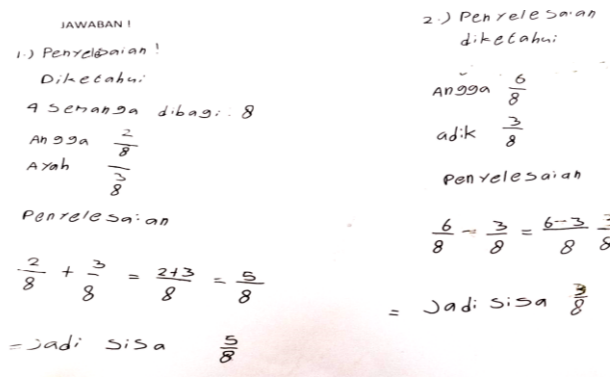

Figure 3: Learning Outcomes of Subject S1

Figure 3 indicates that subject S1 meets the concept comprehension indicators. Subject S1 was able to apply the ability to restate and clarify, as supported by the interview excerpt.

S1: For the first problem, I used addition for the fraction, and for the second problem, I used subtraction because it was about Angga's remaining watermelon.

Based on the interview excerpt, the student (S1) could interpret the meaning of the problem and summarize the given problem effectively. Additionally, the student was able to take responsibility for their problem-solving results.

Furthermore, subject S1 demonstrated the ability to provide examples, explain, compare, and conclude, as supported by the following interview excerpts:

R: What is the difference between Problems 1 and 2?

S1: Problem 2 involves subtraction because Angga's sibling requested it, so it must be subtracted.

R: How did you solve the problem?

S1: I added the numerators for Problem 1, and for Problem 2, I subtracted the numerator.

R: What is the conclusion from both problems?

S1: Father and Angga ate 5/8 of the watermelon; for the second problem, Angga has 3/8 of the watermelon left.

Based on the interview excerpts and learning outcomes, it can be said that subject S1 demonstrated the ability to provide conclusions, comparisons, examples, and explanations. The student answered questions confidently and without hesitation, indicating a high conceptual

understanding. Overall, the conceptual comprehension of students with a high learning interest, such as subject S1, can be considered excellent.

Subject with Moderate Learning Interest (S2)

The learning outcomes show that subject S2 could solve problems well and meet the concept comprehension indicators, as shown in Figure 4.

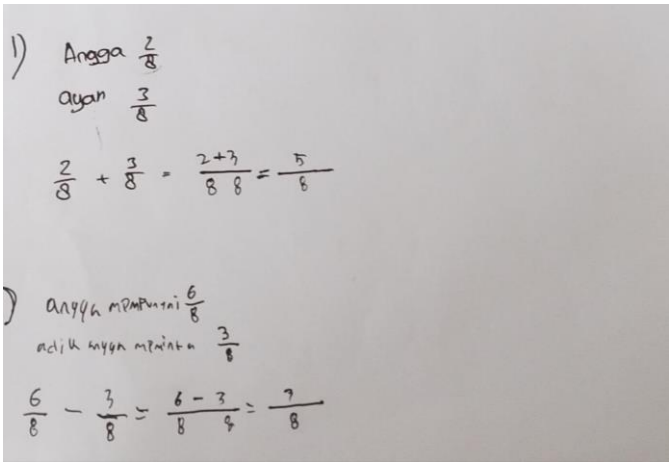

Figure 4: Learning Outcomes of Subject S2

Figure 2 indicates that subject S2 demonstrated the ability to compare, explain, summarize, conclude, and restate. The subject was accountable for the problem-solving results, supported by the following interview excerpt.

R: I want to ask, what did you understand from the problem?

S2: The first problem was about addition, and the second problem was about subtraction.

R: That's correct. How did you know that the first problem was about addition and the second one was about subtraction?

S2: The first problem asked about the total watermelon eaten by Father and Angga, and the second problem was about Angga's remaining watermelon after being requested by his sibling.

R: What's your conclusion from both problems?

S2: Father and Angga ate 5/8 of the watermelon, and for the second problem, Angga has 3/8 of the watermelon left.

Subject S2 displayed the ability to answer questions confidently and without hesitation, showing good conceptual understanding. The conceptual comprehension of students with a high

learning interest, such as subject S1, can be considered excellent. The subject also demonstrated comparing, explaining, summarizing, concluding, and restating skills.

Subject with Low Learning Interest (S3)

The learning outcomes of subject S3 reveal that the S3 did not perform well in problem-solving and could not meet the concept comprehension indicators (Figure 5).

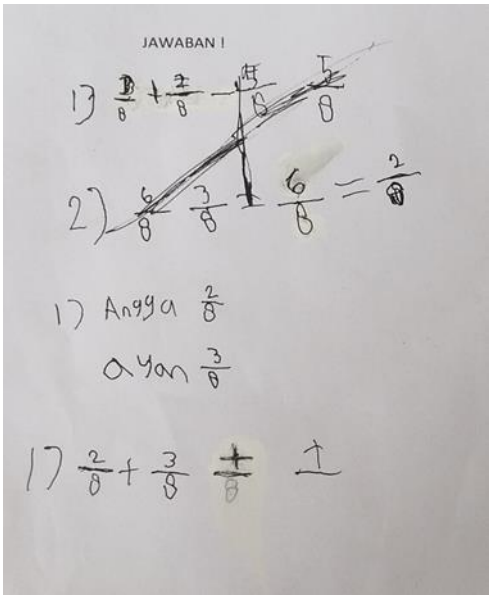

Figure 5: Learning Outcomes of Subject S3

The solutions provided by subject S3 in Figure 3 did not match the problems. During the learning process, subject S3 paid attention but did not actively participate and could not contribute to the learning process or share knowledge with peers. Subject S3 could not meet the concept comprehension indicators. The interview excerpt indicates hesitation and confusion during the questioning:

R: Can you explain how you solved the problem?

S3: By adding them up.

R: Yes, but what do you add together?

S3: The numbers.

R: Which numbers?

S3: I don't know.

Based on the interview excerpt and learning outcomes, it can be concluded that a student with low learning interest, such as subject S3, has a low level of conceptual understanding.

DISCUSSION

Based on Bloom's explanation, comprehension is the ability to absorb meaning and intention from the materials or subjects being learned (Adi & Yulianto, 2018). Additionally, students' conceptual understanding of the subject is determined by their success in learning mathematical content (Purwanti, Pratiwi, & Rinaldi, 2016). Based on the research findings (Ndoen, 2021), some students are reluctant to ask questions when they do not understand the content. Consistent with the results of this study, students with high learning interest have good conceptual comprehension, while students with moderate learning interest also exhibit good conceptual comprehension, but those with low learning interest are noted to have poor conceptual comprehension. Another study highlighted that students with high learning interests achieve better mathematics learning outcomes than those with moderate and low learning interests (Puspitasari, 2019). Meanwhile, students with moderate learning interests perform better than those with low learning interests. However, the research by Fahlevi and Zanthy (2020) found that subjects encounter difficulties in understanding concepts, applying principles, and solving math problems. Not only do students with low mathematical ability experience challenges, but students with high and moderate mathematical ability also encounter difficulties in solving descriptive math problems.

Based on the research findings, it can be concluded that students' conceptual comprehension and attitudes or responses toward mathematics are insufficient. Some students lack interest in mathematics, and their learning interest in the classroom is unstable, leading to reduced concentration. According to previous discussions (Aras, 2019; Komariyah et al., 2018), the emergence of interest is influenced by an individual's inner drive (intrinsic motivation) and social motives, which can stimulate interest in performing specific activities, as well as emotional factors, as interest is closely related to emotions. Success in an activity can lead to happiness, strengthening interest in that activity, while failure can result in unpleasant feelings and diminished interest.

Based on the findings and research results, it can be suggested that improving students' conceptual comprehension can be achieved by increasing their concentration during learning.

This, in turn, is expected to enhance their learning interest in mathematics and their conceptual comprehension.

CONCLUSION

Based on the results and discussions in the research, it can be concluded that students with high learning interests tend to have good conceptual understanding. Similarly, students with moderate learning interests also demonstrate good conceptual understanding. However, students with low learning interest tend to have lower conceptual understanding.

Factors influencing the emergence of learning interest include:

1. Intrinsic motivation: Learning interest can arise from intrinsic motivation within the individual, such as curiosity and interest in a particular subject or topic.
2. Social motives: Social factors, such as peer influence or the social environment around them, can also influence students' learning interests.
3. Emotional factors: Learning interest is closely related to emotions. Achieving success in an activity can result in feelings of joy and strengthen the interest in that activity. Conversely, experiencing failure can lead to unhappiness and decreased interest in the activity.

For future research, it is recommended to use learning media to observe students' interests and conceptual understanding. Engaging and interactive learning media can enhance students' interests and help improve their conceptual understanding. Therefore, future research can be more comprehensive and insightful by employing learning media to observe students' interests and conceptual understanding.

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