



Students' Difficulty in Understanding Problems in the Contextual Problem-Solving Process

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ABSTRACT

The main procedure that students need to master in the problem-solving process is understanding the problem before proceeding to the next steps. This research aims to investigate students' difficulties and the factors causing these difficulties in understanding the problem. This research is qualitative in nature and is based on the philosophy of phenomenology. The research was conducted in an eighth-grade class at one of the Junior High Schools in Bandung, consisting of 28 students. Data collection techniques included tests, interviews, and think-aloud methods. The data collection instruments used were tests and interview guides. The tests used in this research had been previously validated for content, construct, and face validity by mathematics education experts. Data analysis in qualitative research involves data reduction, data presentation, and drawing conclusions. The findings of this research indicate that the difficulties faced by students in understanding the problem include difficulties in comprehending language, difficulties in grasping both explicit and implicit meanings, difficulties in identifying the necessary information, and difficulties in connecting meanings. The main factors causing students' difficulties in understanding the problem are a lack of careful reading skills and a lack of understanding of the concepts held by students.

Keywords: difficulties; understanding problem; problem-solving

INTRODUCTION

Understanding the problem is the first step in solving problems (Bransford & Stein, 1993; Polya, 1957). Bernardo (1999) stated that understanding the task in problem-solving is the most crucial aspect for success. The primary procedure that students must master in problem-solving is to understand the problem before proceeding to the next steps (Polya, 1957). Students who encounter difficulty in understanding the problem will inevitably affect subsequent problem-solving processes (Mokhtar et al., 2019). Difficulty in understanding the problem refers to the challenges students face in grasping the core issue comprehensively.

The results of PISA, for mathematical literacy, Indonesia's ranking in PISA 2022 has improved by 5 positions compared to PISA 2018. In PISA 2022, the international average score for mathematical literacy has decreased by 21 points, whereas Indonesia's score decreased by 13 points, which is better than the international average. Research conducted by Haji et al. (2018) revealed that one of the main obstacles faced by students in tackling PISA questions is difficulty in understanding the problems. Consistent with the PISA results, students' abilities in solving the Minimum Competency Assessment (AKM) Numeracy questions are still relatively low (Fauziah et al., 2022). One of the difficulties

students encounter in completing AKM questions is difficulty in understanding the content of the questions (Cahyanovianty, 2020; Sari et al., 2021).

Several studies in Indonesia have found that students' abilities to understand problems are still relatively low (Ariyani, 2019; Suhita et al., 2013). Research conducted by Suhita et al. (2013) found that students still experience difficulties in understanding problems. Ariyani (2019) found that students do not understand problems when solving story problems.

To assist students in overcoming the difficulties in understanding problems outlined earlier, it is first necessary to provide a clear description of the students' difficulties in understanding problems. In this research, the researchers investigate the difficulties and factors causing students' difficulties in understanding problems. To identify students' difficulties in understanding problems, analysis can be conducted. The difficulties in understanding problems need to be analyzed deeply. Analysis of students' difficulties in understanding problems can be used as a basis for designing better learning to enhance students' ability to understand problems, ultimately leading to improved proficiency in solving contextual problems. Considering the limited research specifically addressing the ability to understand problems, there is a significant opportunity to delve deeper into understanding problem-solving abilities, particularly the difficulties in understanding problems.

RESEARCH METHOD

This research is qualitative in nature. The design used is based on the philosophy of phenomenology. Phenomenology as a philosophy involves intellectual activities in interpretation and meaning-making (Farid, 2018). Phenomenology cannot understand phenomena comprehensively without interpreting individual experiences. Therefore, to understand the phenomenon deeply, hermeneutics is needed, which is a philosophy of interpreting meaning (Simega, 2013).

This research was conducted in one of the 8th grade classes at a junior high school in Bandung, consisting of 28 students. The data collection techniques used in this research were tests, interviews, and think-aloud protocols. After completing the test, 6 students were selected to be the research subjects for in-depth interviews. These six students were chosen based on the characteristics of their answers during the test. The interviews were conducted with the aim of exploring the reasons behind these findings and seeking possible solutions. In the data collection process, the think-aloud method was used, where students were provided with paper and pen to solve problems while explaining their thought process in understanding and solving the problems.

The primary instrument in qualitative research is the researcher themselves. The researcher, as the instrument, will collect, process, and interpret data (Creswell, 2014). Supporting instruments in qualitative research are contextual problem-solving tests and interview guides. The test provided contains 6 contextual problem-solving tasks. The test is given in essay form to allow the researcher to analyze how students think through the answers they provide. Before being administered to the students, the test underwent a validation process by mathematics education experts to ensure the validity of its content,

structure, and overall appearance. The interviews used in this research are semi-structured interviews. Semi-structured interviews are in-depth interviews that also allow for deeper exploration (Magaldi & Berler, 2020). Interviews are conducted until no new information can be obtained or until participants feel they have provided sufficient information.

The data analysis process in this research involves three main stages: data reduction, data display, and conclusion drawing. Miles (Marufi et al., 2022) states that validity in qualitative research includes aspects such as credibility, transferability, dependability, and confirmability.

RESULT AND DISCUSSION

Students' Difficulty in Understanding Problems

The researchers administered a test consisting of 6 contextual problem-solving tasks. Based on the test results from 28 students, the percentage of students experiencing difficulty in understanding problems is shown in Table 1.

Table 1. Students' Difficulty in Understanding Contextual Problems

No	Indicator	Number of students experiencing difficulty
1	Difficulty in understanding language	55%
2	Difficulty in grasping explicit and implicit meanings	72%
3	Difficulty in identifying necessary information and disregarding unnecessary information	54%
4	Difficulty in connecting meanings	79%

Based on the table 1, the most common difficulty faced by students in understanding problems is the difficulty in connecting meanings. 79% of students experience difficulty in connecting meanings. The next most prevalent difficulty, with the highest percentage, is the difficulty in grasping explicit and implicit meanings. 72% of students experience difficulty in grasping explicit and implicit meanings.

Barriers Faced by Students in Understanding Problems

The factors hindering students are the things that cause students to have difficulty in understanding problems that culminate in difficulties for students in solving contextual problems.

Difficulty in understanding language well.

Problem 1:

There are 9 number cards, namely cards with the numbers 5, 17, 25, 3, 10, 11, 9, 15, and 31. Bella takes cards with the numbers 5, 15, and two other cards so that the sum of the four numbers on those cards is 32. What is the ratio of the two numbers on the other two cards?

$$\begin{aligned} \Rightarrow 32 &= 5 + 15 + 20 \\ 32 &= 20 + 9 + 3 \\ \Rightarrow 5 + 15 + 9 + 3 &= 32 \end{aligned}$$

Figure 1. S1's Answer

Figure 1 shows that the student has been able to determine two other number cards so that the sum of the four cards is 32. However, from the results of the answer, it is not apparent that the student has written the answer regarding the ratio between the other two number cards. To confirm the student's answer, an interview with the subject was conducted. The results of the interview can be seen as follows.

P : Can you explain your answer again for this problem?

S1 : Bella took 4 cards, the sum of which is 32. Two cards are already known, which are 5 and 15, making a total of 20. So, the other two cards must total 12. Therefore, the possible cards are 9 and 3.

P : Okay, so far that's correct. But please read the problem again. What is the question?

S1 : The ratio of the two numbers on the other two cards, ma'am.

P : Okay. So, what is the ratio?

S1 : I don't know, ma'am...

P : Do you know what a ratio is?

S1 : No, ma'am.

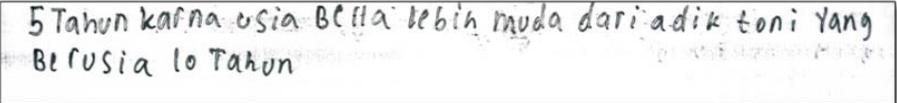
P : Have you heard the word "ratio" before? It has been taught, hasn't it?

S1 : Yes, ma'am. I've heard it before. It has been taught, but I forgot.

Based on the answers and interview results with S1, the student had difficulty in understanding the word "ratio." The factors contributing to this difficulty include the student's lack of understanding of the concept of ratio, which consequently led to an inability to determine the correct approach to finding the answer. The student's insufficient knowledge of the word resulted in an inability to interpret it accurately.

Problem 2:

Toni has a younger sibling. The age of Toni's sibling is 5 years younger than Bella's age. If Toni's sibling's age is currently 10 years old, how old is Bella now?



5 Tahun karena usia Bella lebih muda dari adik toni yang 10 tahun

Figure 2. S2's Answer

Figure 2 shows that the student cannot answer Problem 2 correctly. This can be seen from the incorrect calculation results, where the student's final answer is 5 years, whereas the correct answer is 15 years. To confirm the student's answer, an interview with the subject was conducted. The results of the interview can be seen as follows.

P : Can you explain your answer to this problem again?

S2 : Bella's age is 5 years, ma'am. Bella is younger than Toni's sibling.

P : Why did you answer 5 years?

S2 : Because it says 5 years younger, ma'am. So, it should be subtracted.

P : Your answer is still wrong. Toni's sibling is 5 years younger than Bella. So, who is younger? Toni's sibling or Bella?

S2 : Toni's sibling, ma'am?

P : Yes, that's correct. Toni's sibling is indeed younger, not Bella. Then why did you write that Bella is younger?

S : The language is too difficult to understand, ma'am.

Based on the answers and interview with S2, the student couldn't comprehend the phrase "5 years younger than." The factors contributing to this include the student's insufficient understanding of the concept of age comparison, resulting in the inability to grasp the phrase "5 years younger than" effectively. Additionally, based on the interview results, it was found that the student lacks carefulness in reading the problem, leading to errors in determining calculation techniques, and the student couldn't complete the solution steps until interpreting the phrase "5 years younger than."

Problem 3:

A mother's age is 5 years older than 3 times the age of her daughter. If the mother's current age is 41 years old, what is the daughter's current age?

usia ibu = 41 tahun
anak perempuan = 26
 $5 \times 3 = 15$
 $41 - 15 = 26$

Figure 3. S3's Answer

The figure 3 shows that the student couldn't answer Problem 3 correctly. This can be seen from the incorrect calculation results, where the student's final answer is 26 years, whereas the correct answer is 12 years. From the answer, it can be observed that the student still misunderstood the sentence "A mother's age is 5 years older than 3 times the age of her daughter." The student's solution steps didn't reflect the meaning of the sentence, as the student made a mistake in the calculation by multiplying 5 and 3. To confirm the student's answer, an interview with the subject was conducted.

P : Can you explain your answer to this problem again?

S3 : Because it says in the problem that it's 5 years older than 3 times the daughter's age, so what's sought is 5×3 , which is 15. Then subtract $41 - 15 = 26$. So, the daughter's age is 26 years, ma'am.

P : Are you sure the meaning of "5 years older than 3 times the daughter's age" is 5×3 ?

S3 : Actually, I'm not sure, ma'am.

P : The meaning of "A mother's age is 5 years older than 3 times the daughter's age" is not 5×3 . Have you tried reading the problem repeatedly to understand the sentence?

S3 : Not yet, ma'am.

Based on the answers and interview with S3, the student couldn't interpret the sentence "A mother's age is 5 years older than 3 times the daughter's age." The factors contributing to this include the student's lack of carefulness in interpreting sentences containing phrases, resulting in an inability to determine the correct solution. The student didn't attempt to read the problem repeatedly to understand the sentence "A mother's age is

5 years older than 3 times the daughter's age." The difficulties found above align with the findings of Herman et al. (2022), which identified that one of the main factors causing students difficulty in understanding problems is the difficulty in interpreting language, whether in words, phrases, sentences, or across sentences.

Difficulty in grasping both explicit and implicit meanings.

Explicit meaning refers to the meaning that is directly stated in the text and does not require additional interpretation. Meanwhile, implicit meaning refers to the hidden or unstated meaning within the text or statement. It is the meaning that needs to be uncovered or inferred based on understanding and reasoning.

Problem 4:

Mr. Hadi has a garden with a rectangular shape. Mr. Hadi plans to plant miniature elephant grass throughout the garden area. The perimeter and width of Mr. Hadi's garden are 50 meters and 10 meters, respectively. The price of miniature elephant grass is Rp20,000 per square meter. If Mr. Hadi has Rp5,000,000, how much money does he have left after buying the grass?

Dik = keliling > 50m
 lebar > 10m
 Harga > Rp. 20.000 / meter²

= 50 meter x Rp 20.000 → $\begin{array}{r} 20.000 \\ 50 \\ \hline 1.000.000 \end{array}$

= Rp. 1.000.000

→ 10 meter x Rp 20.000 → $\begin{array}{r} 20.000 \\ 10 \\ \hline 200.000 \end{array}$

→ Rp 200.000

Total → Rp. 1.200.000

Sisa → $\begin{array}{r} \text{Rp. } 5.000.000 \\ \text{Rp. } 1.200.000 \\ \hline 3.800.000 \end{array}$

Figure 4. S4's Answer

Problem 4 contains both explicit and implicit meanings. S4 couldn't answer Problem 4 correctly. S4 didn't determine the length and area of the garden first. In solving Problem 4, S4 multiplied the perimeter of the garden by the price of grass per square meter, multiplied the width of the garden by the price of grass per square meter, and then added the prices together. To confirm the student's answer, an interview with the subject was conducted. The results of the interview can be seen as follows.

P : Can you explain your answer to this problem again?

S4 : The perimeter is 50, the width is 10. And the price of the grass is 20,000 per meter. I multiplied 50 by 20,000 which is 1,000,000. Then I multiplied 10 by 20,000 which is 200,000. Then the total is 1,200,000. Since Mr. Hadi's money is 5,000,000, then the remaining money is 3,800,000.

P : Yes. Your method is still incorrect. The price of the grass is 20,000 per square meter. Which means you need to find the area of the garden first. Do you know how to find the area if the perimeter and width are known?

S4 : *I forgot how to do it, ma'am.*

Based on the answers and interview with S4, the student couldn't grasp the implicit meaning of the given problem. The student didn't seek the values of the length and area of the garden beforehand. The factors contributing to this include the student's lack of contextual knowledge. Understanding implicit meanings requires an understanding of the context surrounding the text or situation given. If students do not have sufficient understanding of the context, they may struggle to grasp implicit meanings. In this case, the student's understanding of the context regarding the area of a rectangle is lacking. The difficulties above align with the views of Emanuel et al. (2021), who suggest that students may not understand problems because they have difficulty digesting meanings effectively, leading to struggles in comprehension.

Difficulty in identifying necessary information and disregarding unnecessary information

Problem 5:

Rafael plans to buy a new bike brand A. Rafael has savings of Rp2,500,000 and Rp750,000 from his mother. The next day, Rafael reads a brochure from the "Golden Bike" Bicycle Shop with the following price list. The price of brand A bike at the shop is Rp3,000,000. The brochure also states that the purchase of a brand A bike will receive a 10% discount, and the purchase of a brand B bike will receive a 20% discount. Determine the price of the brand A bike after the discount.

Jadi harga sepeda A 6.250.000

$$\begin{array}{r} 2.500.000 \\ + 750.000 \\ \hline 3.250.000 \end{array} + \begin{array}{r} 3.000.000 \\ + 3.250.000 \\ \hline 6.250.000 \end{array}$$

Figure 5. S5's Answer

In the above problem, students are required to identify necessary information and disregard unnecessary information. The required information is the price of the brand A bike and the discount percentage for the brand A bike, which is 10%. The rest is irrelevant information and should be disregarded. In S5's answer, the student used irrelevant information to solve the problem. The student was misled by the unnecessary information. From the answer and interview with S5, the student couldn't identify the necessary information. The factors contributing to this include the student's inability to assess relevance. The student has difficulty in determining what is relevant and what is not. The student feels that all information in the text is important. Another factor is the student's lack of understanding of concepts or contexts. Without sufficient understanding of specific concepts or contexts, students may not know what information is needed. The student's difficulties align with the research of Febrianti & Nurjanah (2022), who found that one of the students' difficulties is that they are unable to distinguish relevant information (for example, using all the information provided in the problem or disregarding relevant information) or unable to gather necessary information that is not provided in the problem.

Difficulty in connecting meanings.

Problem 6:

Adi, Budi, Cyndi, and Demas often work on assignments in groups. The houses of Adi, Budi, Cyndi, and Demas are in sequence from left to right. On Monday, Adi rode his bike to Cyndi's house, covering a distance of 300 meters. On Tuesday, Budi walked to Demas's house, covering a distance of 550 meters. The distance from Adi's house to Budi's house is the same as the distance from Budi's house to Cyndi's house. Determine the distance from Adi's house to Demas's house.

Karena adi berangkat ke rumah Cyndi menggunakan sepeda maka adi juga akan ke rumah Demas mengendarai sepeda.

Jarak : ADI - Cyndi = 300 m
 ADI - BUDI = $300 : 2 = 150$ meter / Rumah
 ADI - Demas = $150 \times 3 = 450$ meter (sepeda)

Figure 6. S6's Answer

To confirm the student's answer, an interview with the subject was conducted. The results of the interview are as follows.

P : How did you know that the distance from Cyndi's house to Demas's house is 150m?

S6 : Because the distance from Adi's house to Budi's house is 150m and the distance from Budi's house to Cyndi's house is 150m.

P : Were you informed that the distances from Adi's house to Budi's house, from Budi's house to Cyndi's house, and from Cyndi's house to Demas's house are the same?

S6 : Not really, ma'am

From the answers and interview with S6, the student couldn't connect the meanings between the given pieces of information to solve the problem. The factors contributing to this include the student's lack of understanding of basic concepts. This difficulty is often caused by a lack of understanding of basic mathematical concepts. Before someone can connect meanings in a math problem, they must have a strong understanding of basic concepts such as numbers, operations, comparisons, and so on. Another contributing factor is the student's lack of problem-solving strategies. The student doesn't have effective strategies to solve the given problems. The student doesn't know where to start or how to connect the steps to reach a solution.

CONCLUSION

The difficulties faced by students in understanding problems include difficulty in understanding language, difficulty in grasping explicit and implicit meanings, difficulty in identifying necessary information, and difficulty in connecting meanings. The main contributing factors to students' misunderstanding of problems are lack of precision and insufficient understanding of concepts. Based on the findings and discussion, the author can propose several solutions to improve students' understanding of mathematical problems, which can serve as a reference for further research. Firstly, there is a need to enhance teaching precision and structure by clarifying mathematical terms and concepts

clearly and systematically. Secondly, adopting instructional approaches that encourage students to identify both explicit and implicit information in problems and connect various meanings is crucial. Thirdly, developing teaching materials or practice problems that support better understanding, taking into account language context and writing that minimizes ambiguity in problem interpretation. By implementing these solutions, it is expected to reduce students' difficulties in understanding mathematical problems and enhance the overall quality of mathematics education.

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