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ANALYSIS OF MATHEMATICAL REASONING ABILITY AS SEEN FROM STUDENTS' UNDERSTANDING OF CONCEPTS IN SOLVING PISA QUESTIONS ON CHANGE AND RELATIONSHIP CONTENT

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Abstract

This study aims to determine students' mathematical reasoning abilities in solving PISA questions with change and relationship content and to identify the extent to which conceptual understanding influences students' mathematical reasoning abilities in solving PISA questions with change and relationship content. This study uses a qualitative descriptive method. The instruments used are written tests and interviews. The subjects of this study were eighth-grade junior high school students, with a sample size of 31 students, from which three subjects were selected: high, medium, and low. The results of the study showed that subjects in the high mathematical reasoning ability category were able to meet all indicators of mathematical reasoning and conceptual understanding. Subjects at a medium level mathematical reasoning ability category were able to meet 3 out of 4 mathematical reasoning indicators. Meanwhile, subjects with low mathematical reasoning ability faced significant difficulties and were unable to meet the mathematical reasoning indicators. This indicates that conceptual understanding is crucial in influencing students' mathematical reasoning ability in solving PISA questions with content related to change and relationships.

Keywords: reasoning, concept understanding, change and relationship

Abstrak

Penelitian ini bertujuan guna mengetahui kemampuan penalaran matematis siswa pada menyelesaikan soal PISA dengan konten *change and relationship* dan untuk mengidentifikasi sejauh mana pemahaman konsep mempengaruhi kemampuan penalaran matematis siswa pada menyelesaikan soal PISA dengan konten *change and relationship*. Penelitian ini menggunakan metode deskripsi kualitatif. Instrumen yang digunakan merupakan tes tertulis dan wawancara. Siswa SMP kelas VIII ialah subjek penelitian ini disertai sampel siswa sebanyak 31 orang kemudian dipilih 3 subjek tinggi, sedang, dan rendah. Hasil pengkajian membuktikan bahwasannya subjek disertai kategori kemampuan penalaran matematis tinggi mampu mencukupi semua indikator penalaran matematis dan indikator pemahaman konsep. Subjek dengan kategori kemampuan penalaran matematis sedang mampu memenuhi masing-masing 3 indikator dari 4 indikator penalaran matematis. Sedangkan subjek dengan kemampuan penalaran matematis rendah banyak mengalami kesulitan dan tidak mampu mencukupi indikator penalaran matematis. Ini menunjukkan bahwa pemahaman konsep begitu penting untuk mempengaruhi proses kemampuan penalaran matematis siswa pada menyelesaikan soal PISA konten *change and relatioship*.

Kata kunci: Penalaran, Pemahaman Konsep, *Change and Relationship*

INTRODUCTION

Mathematics is a compulsory topic area that should be studied from childhood to college. However, the majority of students consider that math is one of the boring lessons because it is difficult to understand, this view can have an effect on the dynamics of students' learning continuity in mathematics (Cahya & Warmi, 2019). Based on the National Council of Teachers of Mathematics (NCTM) in (Wahyuni & Kharimah, 2017) revealed that there are five

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main abilities that need to be achieved in mathematics learning, namely: 1) communication skills, 2) representation skills, 3) problem solving skills, 4) connection skills, and 5) mathematical reasoning skills. The mathematical ability that will be examined in the context of this research is mathematical reasoning ability. In the process of exploring mathematical material, mathematical reasoning is needed by students when solving problems that arise in everyday life (Hariyanti & Khotimah, 2022).

In mathematics education, mathematical reasoning is an important competency because it plays a role in building students' conceptual understanding of mathematical material. Reasoning is a basic skill that must appear in mathematics (Suyanti & Waluyo, 2024). (Herizal et al., 2020) which explains that mathematical reasoning ability as one of the essential skills that learners must develop to master after studying mathematics. Mathematical reasoning ability is proof that can be accounted for accuracy, which is obtained from the ability to think in drawing conclusions on a problem based on data analysis and regulation of previously obtained inferences (Selvia et al., 2019).

According to Kuo's theory, conceptual understanding is involved in fostering the development of students' mathematical reasoning. Those students who are able to combine conceptual understanding with various types of reasoning tend to be more successful in solving problems effectively. The learning approach should be designed to encourage students not to rely solely on mathematical calculations, but also to understand the conceptual meaning of the equations used (Kuo et al., 2013). Research findings (Annisa, 2022) demonstrate that mathematical reasoning positively and significantly contributes to students' insight into mathematical concepts. Thus, a good grasp of concepts can enhance mathematical reasoning skills, especially when facing complex problems such as PISA questions.

Based on the findings of PISA (Program for International Student Assessment), Indonesia's mathematics point ranked 67th out of 78 participating countries. This ranking shows an improvement compared to 2018, when Indonesia ranked 72nd out of 78 countries. The low mathematics scores in Indonesia's PISA results are believed to be related to students' low mathematical reasoning abilities. Preliminary studies conducted by researchers indicate that many students still struggle with PISA questions at levels 4, 5, and 6. Students generally

only manage to answer questions at levels 1 to 3, while levels 4 to 6 remain challenging for many.

The cause of low mathematical reasoning is influenced by several factors. According to (Sunaisah Sunaisah et al., 2024), the factors that affect students' mathematical reasoning ability include: lack of conceptualization of fractions, limited practice of story problems, low student learning motivation, and inatructional approaches that lack diversity and seldom incorporate educational tools or learning resources. According to (Putri et al., 2022), the factors that cause the lack of proficiency in mathematical reasoning of students in algebraic material include: students do not understand or master the concepts adopted to solve problems, students have difficulty when changing story problems to algebraic form, and students have not trained themselves enough to complete various practice problems to expand and deepen the learning material, as well as repetition of the material provided.

From some on the identified factors influencing mathematical reasoning skills, it can be inferred indicating the various elements affecting the low mathematical reasoning ability are: 1) limitations in understanding concepts, 2) lack of practice problems and repetition of material, 3) limitations in the application of knowledge, 4) personal factors of students, and 5) teaching methods are less varied. Concept understanding constitutes one of the reasons that cause the ability in mathematical reasoning. Concept understanding is a condition where students prove and discover a concept by themselves not through memorization (Nurafni et al., 2018). Understanding of concepts is the basic skill of interpreting concepts, namely when someone is able to translate the concepts obtained back into more accessible language to digest (Tetiwar & Appulembang, 2018). Based on various opinions of various experts, this leads to the conclusion that concept understanding refers to students’ capability to get, prove, and understand a concept without relying on the memorization process.

To provide convenience in efforts to improve students' mathematical procedural insights, strong concept knowledge is needed. Dahar (Hutagalung, 2017) states that “When likened, concepts are various building stones in the dynamics of thinking”. Students will find it difficult to work towards higher learning dynamics if the concepts are not fully understood. The results of the realization of the survey conducted by the Programme for International Student Assessment (PISA) in 2022 showed that students in Indonesian' skills in understanding mathematical concepts were still low compared to other countries. PISA 2022

showed a decline in learning achievements internationally, especially in understanding mathematical concepts. The average score of Indonesia's math skills dropped 13 points to 366, from the previous edition's result of 379 (Batee, 2023).

PISA (The Program for International Student) is an examination structure under the OECD that intends to assess the education systems of 72 countries in the world. PISA's mathematics questions focus on measuring reasoning, problem-solving, and argumentation skills, rather than questions that test technical skills related to memory and calculation that are often practiced. PISA questions are separated into four contents namely Change and Relationship, Uncertainty and Data, Quantity, and Space and Shape (Qadry et al., 2022). In this study, students were tested to complete the PISA questions on Change and Relationship content.

The PISA 2022 results show that the “Change and Relationship” content scored 362, ‘Quantity’ scored 363, “Space and Shape” scored 367, and “Uncertainty and Data” scored 363. This result shows that the Change and Relationship content has the lowest score among the four contents. Change and Relationship content in PISA questions requires students to recognize patterns of change and relationships between variables in different contexts. This ability requires in-depth analysis, abstraction, and application of mathematical concepts in real situations (Yulianto et al., 2023). The problems found in PISA questions, especially the change and relationship content, do not only focus on the skills of applying concepts, as well as include how these concepts are employed in diverse situations (OECD, 2017).

Several previous studies have examined PISA questions from various perspectives. The difficulty felt by students in completing PISA questions is due to lack of skill in converting everyday sentences into mathematical sentences (Sari & Valentino, 2017). According to Aini in (Fadillah & Ni’mah, 2019) said that student missteps in working through PISA assessments related to the content of change and relationships are caused by a shortfall in the ability to reason and student skills in efforts to resolve matters linked to real contexts and convert them into algebraic form. Therefore, this study aims 1) to determine students' mathematical reasoning ability in solving PISA questions with change and relationship content 2) to identify the extent to which concept understanding affects students' mathematical reasoning ability in solving PISA questions with change and relationship content.

METHODS

This research adopts a qualitative approach. Qualitative research methods are research methods that operate naturally in the space under study without the help of researchers, and qualitative research focuses on understanding meaning rather than generalization (Sugiyono, 2020). The design adopted in this study is a qualitative description. According to Nana Syaodih Sukmadinata in (Destiani Putri Utami et al., 2021), qualitative descriptive research is shown to explain and show various phenomena that exist and are natural or man-made, which tend to emphasize the quality, characteristics, and relationships in each activity.

This study was realized at SMP Muhammadiyah PK Kottabarat Surakarta. The research time was conducted in February 2025. VIII grade students are the subjects in the dynamics of this study. The research subjects were determined based on their conceptual understanding abilities, and three students were selected from the high, medium, and low categories. One student was selected from each category. The techniques applied for data collection were written assessments and interviews. The assessments took the form of a modified PISA content description of change and relationship and totaled 3 items. Indicators of mathematical reasoning ability (Asdarina & Ridha, 2020) adopted are: 1) make conjectures, 2) perform mathematical manipulations, 3) compile evidence or provide reasons for the correctness of the solution, 4) draw conclusions from the statements given.

After the data was collected, the researchers processed the test data with scoring guidelines in the form of mathematical reasoning assessment criteria that the researchers had made. Then the data analysis technique used uses a 100 scale accompanied by the following formula:

$$\text{Student score} = \frac{number\ of\ scores\ obtained}{maximum\ number\ of\ total\ scores} \times 100$$

Then for the high, medium, low and high segments depending on the written test criteria, namely:

Table 1. Pisa Written Test Categories of Change and Relationship content

Category	Score
High	X < Mean - 1.SD
Medium	Mean – 1. SD ≤ X < Mean + 1. SD
Low	Mean + 1. SD ≥ X

Description:

X = Value obtained by students

Mean = Average Value

SD = Standard Deviation

The next data collection technique is interviews. Interviews were conducted with 3 students, each representing a different category. The interview guidelines were based on the concept understanding indicators. The indicators of concept understanding (Marbun et al., 2022) used are as follows: 1) the skill to rephrase a concept, 2) the skill to provide examples and counterexamples of concepts, 3) the skill to express concepts in various mathematical forms, 4) the skill to apply concepts to problem solving. Techniques for analyzing data used include data reduction, data presentation, and conclusion drawing. Data validity was done by triangulation method.

RESULTS AND DISCUSSION

Result

Based on the implementation of mathematical reasoning skills test of students in class VIII C SMP Muhammadiyah PK Kottabarat Surakarta, the results obtained on the completion of PISA items related to the content of change and relationship with the acquisition of presentations in the low category reached 9.68%, in the medium category 74.19%, and in the high category 16.13%. So, it can be explained that the mathematical reasoning ability of the 8th grade students of SMP Muhammadiyah PK Kottabarat Surakarta is moderate.

Table 2. Data on Students' Mathematical Reasoning Ability

Interval Score	Category Ability	Many Categories	Number of Students
X < M-1.SD	Low	**3**	
M-1.SD ≤ X < M+1.SD	Medium	**23**	**31**
M+1.SD ≤ X	High	**5**	

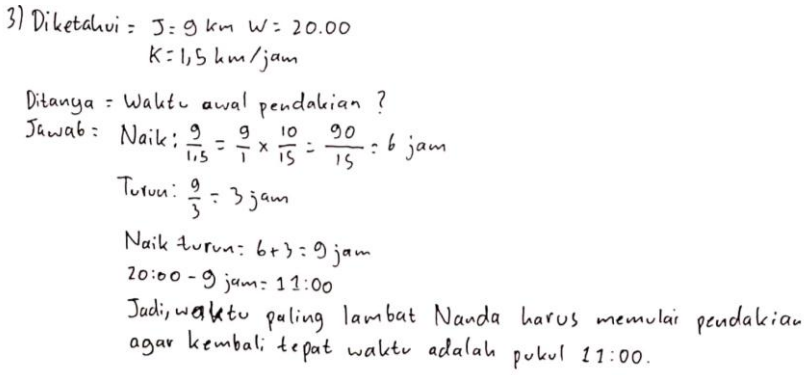
The subsequent section presents a description of the data analysis of the written test of mathematical reasoning ability on the research subject.

1. Analysis of Students with High Mathematical Reasoning Ability Criteria (ST)

   Drawing upon the performance results of the written test, subjects who fall into the high category are cap]able of meeting the four meansures of mathematical reasoning ability. In completing the problem, the subject can successfully achieve the indicator related to making conjectures correctly and understanding the relationship between the concepts used. The subject is able to estimate the right answer and knows the steps of problem solving. As indicated by the results of the

concept understanding interview, the subject was able to fulfill the indicators of the ability to express a concept again.

Original Version:



Translate Version:

3) Known = J = 9 km W = 20.00

K = 1,5 km/hour

Question = when did start climbing?

Answer = climbed up : $\frac{9}{1,5} = \frac{9}{1} \times \frac{10}{15} = \frac{90}{15} = 6$ hour

Climbed down: $\frac{9}{3}$ = 3 hour

Climbed up and down = 6+3 = 9 hour

20.00 – 9 hour = 11:00

So, the latest time you should start climbing in order to return on time is at 11:00.

Figure 1. High Subject Answers Math Manipulation Indicator

In the indicator of performing mathematical manipulation systematically the subject is able to fulfill to obtain the correct solution. The written test results in Figure 1 explain that the subject can develop a strategy for solving contextual problems into mathematical problems such as in problem number 3. The related matter is strengthened through the results of the realization of the concept understanding interview that the subject is able to realize the fulfillment of the indicators of the capacity to explain concepts in different kinds of math representation.

P : okay. What are your difficulties in modeling this problem (showing problem number 3) into a mathematical model? This was not a mathematical model before.

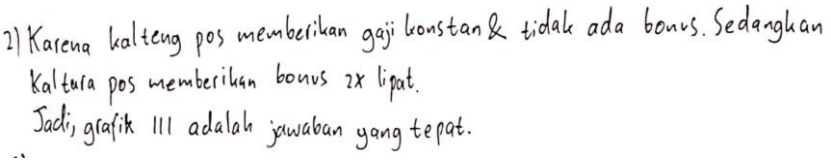
ST : Yes, I started like this, my difficulty was eemm nothing. Yes, it's just a bit confused to see this (pointing to the student's answer) converted into a variable is a bit confused, but after reviewing it again it turns out that it can.

P : So you were confused when you wanted to generalize like that?

ST : Yes, because from the story problem made into like this to this variable, it is rather complicated, so it must be analyzed again.

The subject explained that initially there was no difficulty in converting the contextual question into a mathematical model but the subject finally answered a little confusion in formalizing it. Even so, the subject can still solve the problem correctly and precisely.

Original Version:



Translate Version:

2) Because Kalteng Pos provides a fixed salary and no bonuses, while Kaltara Pos provides double bonuses.

So, graph III is the correct answer.

Figure 2. High Subject Answers Indicator of Arranging Evidence or Providing Reasons for the Correctness of the Solution

In the indicator focused on assembling evidence or reasoning to support the correctness of the answer, the subject fulfills this indicator. Evidently, the subject can complete problem number 2 correctly and include the reasons for his answer. The subject is able to provide logical reasons in accordance with the data obtained from the problem. The related matter is in line with the concept understanding interview which states that the subject has the ability to fulfill the indicators of the ability to re-explain a concept.

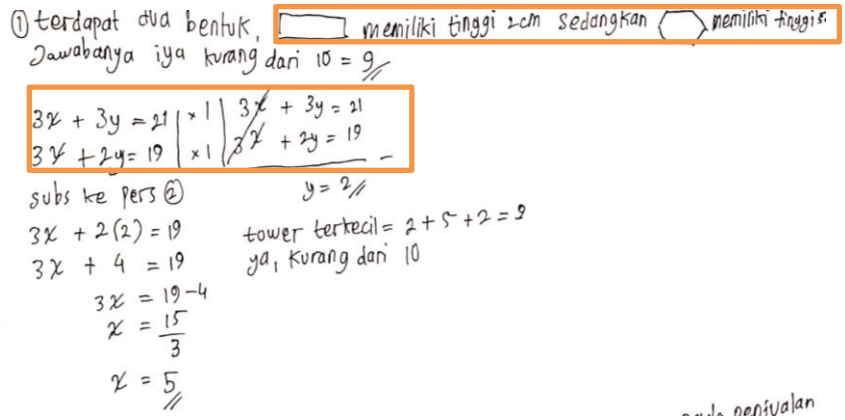
In the indicator of drawing conclusions through various structured steps, the subject can draw logical conclusions from the given statement. Based on the test results, the subject was able to conclude the smallest tower height, determine the correct graph and was able to conclude the slowest time to start climbing.

Based to the findings of the interviews on other indicators of concept understanding, the subject is capable of meeting the indicator of describing examples and non-examples of the concept. So, it is concluded that the subject ST can fulfill 4 indicators of concept understanding which are used as interview guidelines. This proves that subjects with high mathematical reasoning skills also have high concept understanding. Strong concept understanding makes it easier for subjects to choose effective solution strategies.

2. Analysis of Students with Moderate Mathematical Reasoning Ability Criteria (SS)

Based on the results data from the written examination of students who fall into the moderate category, it shows that most of them can only achieve 3 indicators of mathematical reasoning skills. In the section indicator of drawing conclusions, moderate students often make mistakes in solving problems and some cannot draw conclusions in solving problems.

Original Version:



Translate Version:

1) There are two shapes,  one is 2 cm high and the other  is 5 cm high

The answer is yes, less than 10 = 9

$$3x + 3y = 21 \mid \times 1 \mid 3x + 3y = 21$$
$$3x + 2y = 19 \mid \times 1 \mid 3x + 2y = 19$$

$$y = 2$$

Substitute into the equation (2)

$$3x + 2(2) = 19$$
$$3x + 4 = 19$$
$$3x = 19 - 4$$
$$x = \frac{15}{3}$$
$$x = 5$$

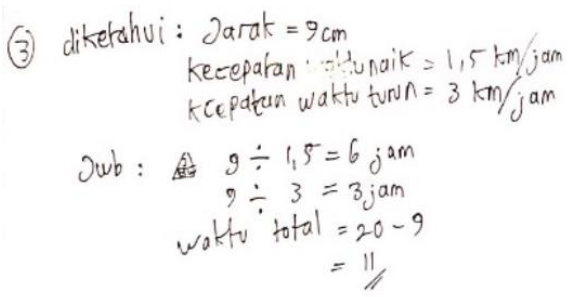
The smallest tower = $2 + 5 + 2 = 9$

Yes, less than 10

Figure 3. Medium Subject's Answer for the Indicator of Conjecture

On the indicator of making conjectures, moderate subjects are able to fulfill the indicator. The subject can understand the problems included and describe what is understood about the problem through writing. The initial step taken by the subject is to model a rectangle with a height of 2 cm and a hexagon with a height of 5 cm. Furthermore, in the work the student uses the variables x, y, even though the initial step there is no information on what the variables x and y are. But students can answer correctly that the height of the small tower is less than 10, namely 9.

Original Version:



Translate Version:

3) Known: distance = 9 cm

Ascent speed = 1.5 km/hour

Descent speed = 3 km/hour

Answer: 9 : 1.5 = 6 hours

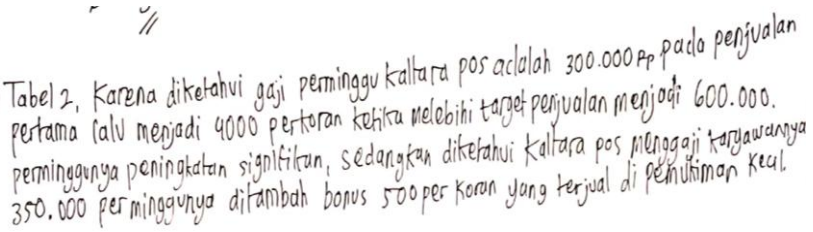
9 : 3 = 3 hours

Total time = 20 - 9 = 11

Figure 4. Medium Subject Answers Indicators of Doing Mathematical Manipulation

In the indicator of performing mathematical manipulation, the subject was able to fulfill the indicator. The participant can perform the solution to the mathematical model correctly. Figure 4 shows the test results that the subject could change the story problem to a mathematical model. The subject wrote down the information in the problem and then entered the numbers into the formula. According to the results of the concept understanding interview, it proves that the subject can meet the indicators of the ability to describe concepts in various types of mathematical representations, the subject stated that he did not find it difficult to model contextual problems into mathematical models. And the results of interviews for indicators of the ability to us concepts in problem-solving can also realize the fulfillment of related indicators.

Original Version:



Translate Version:

Table 2, because it is known that Kaltara Pos' weekly salary is 300,000 for sales of

and then 4000 per newspaper when the sales target is exceeded to 600,000. There is a significant increase per week, while Kaltara Pos pays its employees 350,000 per week plus a bonus of 500 per newspaper sold in small settlements.

Figure 5. Medium Subject Answers Indicators of Compiling Evidence or Giving Reasons for the Truth of the Solution

For indicators, compiling evidence or providing justifications for the accuracy of the solution, the subject is capable of meet the indicators. In Figure 5, the subject is capable of answer even if the answer is wrong, but can still contribute the reason for the answer written. In the answer, the subject was able to calculate the salary per week from the Kaltara Pos newspaper media but miscalculated the salary when the newspaper's sales exceeded the target. Although there are slight errors in the writing of reason, the subject shows a fairly good comprehension of the concept

and tries to explain his thought process in an attempt to handle the problem. The conclusions drawn from the concept understanding the interview revealed that the subject was capable of achieve an indicator of the ability to restate a concept but experienced a little difficulty. The subject is able to answer questions in the interview session but has difficulty explaining the answers he or she will reveal.

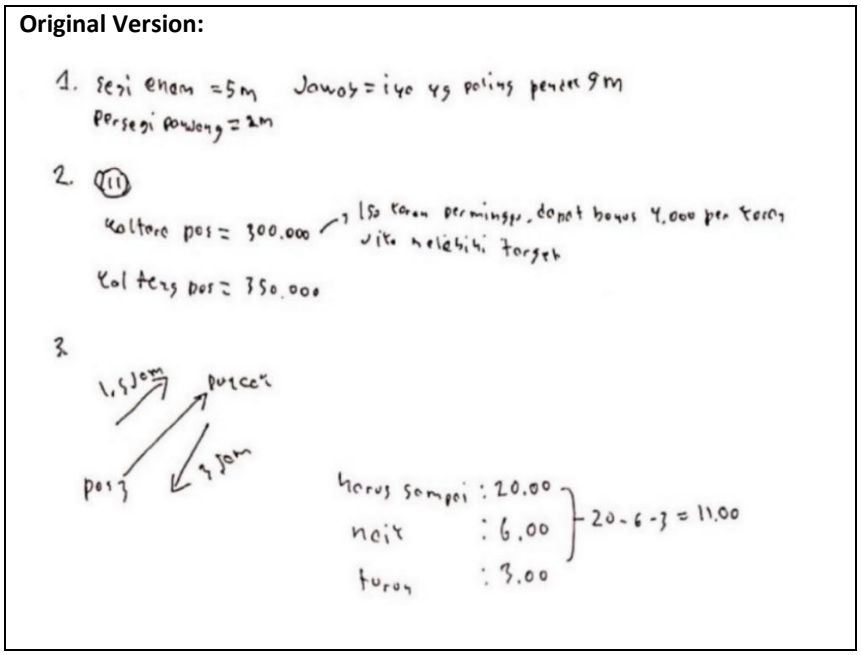
And for the indicator to draw conclusions on the given statement, the subject is less able to meet the indicator accurately. In doing the written test, mistakes were found in the attempt to draw conclusions and there were answers that were not concluded. Similar to the results of the concept understanding interview, for indicators of ability to mention examples and non-examples of the subject's concept, they can convey examples from SPLDV. However, the subject could not give a reason why students were able to answer the question.

This indicates that the medium subject is able to only achieve 3 indicators out of the 4 indicators of mathematical reasoning ability and can achieve 4 indicators of concept comprehension but there is still a slight error in any of the indicators.

3. Analysis of Students with Low Mathematical Reasoning Ability (SR)

Criteria Based on test result data for students in the low category, it shows that they can only achieve 2 indicators of mathematical reasoning ability.

Original Version:



Translate Version:

1. hexagon = 5 m

   rectangle = 2 m

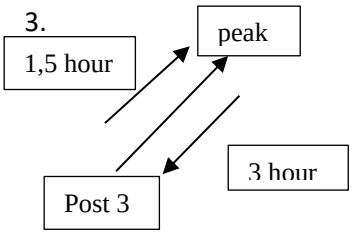
   answer = yes, the shortest is 9 m

2. II

   Kaltara Pos = 300,000 (150 newspapers per week, with a bonus of 4,000 per newspaper if the target is exceeded

   Kalteng Pos = 350,000

3.



must reach: 20,00

Increase: 6.00

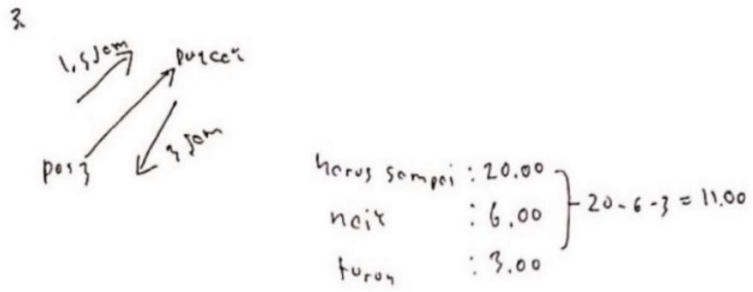
Decrease: 3.00

20 – 6 - 3 = 11.00

Figure 6. Low Subject Answers Indicators Propose Guesses

In the indicator, the subject is suspected to be able to achieve the indicator. Subjects have the ability to find problem-solving solutions. From the written test in figure 6 indicates that the subject can organized the information understood. Related matters are in harmony with the results of the concept understanding interview that the subject in the indicator of the capability to implement the concept to resolving problems the subject can achieve the indicator.

Original version :



Translate version :

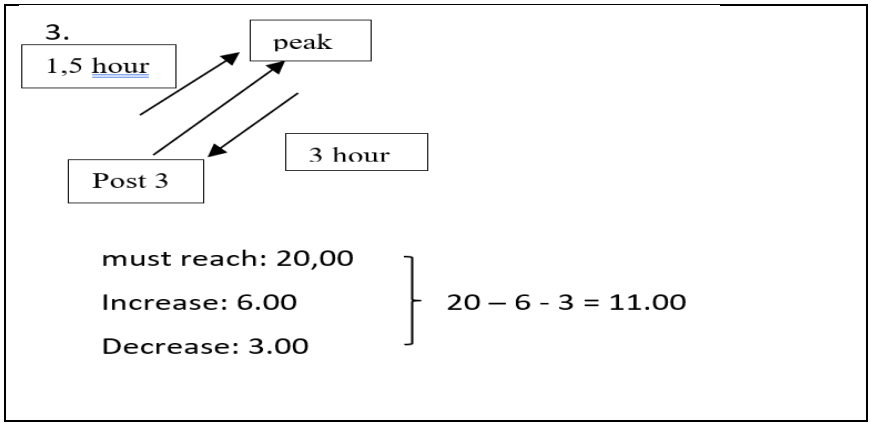


Figure 7. Low Subject Answers Math Manipulation Indicators

Mathematical Manipulation Then the indicator of performing mathematical manipulation demonstrates that the subject can meet the indicators but has errors in writing. The subject knows the pattern of working on problem number 3 and writes down the solution. It is proven in figure 7 that the subject can answer question number 3 accurately and write down the information found in the question, but the subject is not capable of solving the problem correctly and completely. It is true that the subject can write that the time of ascending is 6 hours and for the time of descent it is 3 hours. However, the subject did not explain where the time was obtained because there was no information on the time in the question. The subject also wrote the wrong time, namely the subject wrote 6.00 and 3.00. Because such writing shows what time it is, not how long it is.

The low subject plots the solution of the problem using the example. However, the results of the written test have not been able to write down the solution toward the problem. This proves that the low subject has not been able to realize the fulfillment of the indicators of compiling evidence. So that the subject cannot draw the right conclusions from the results of his work. This is driven by the results of the interview understanding of concepts showing that the subject can only meet 2 indicators out of the 4 interview guideline indicators. In other indicators of concept understanding, the results of the interviews stated that the subjects were lacking in achieving the indicator of the ability to restate a concept and the indicator of the ability to present concepts in different mathematical representations.

P : What kind of example of questions from SPLDV do you know?

SR : um, yes, it seems like there are two equations looking for ee like how much like 3 pencils 2 books = 26 thousand, then 5 pencils 3 books = 50 thousand. How much does 2 pencils cost 2 books.

P : Okay. It means you know. What is the reason you chose the example of the problem you have explained?

SR : see in the question.

P : If you don't have a problem with it. You are constantly asked to give an example of the SPLDV question, then you answer as you mentioned earlier, why do you think about it? So what is your reasoning.

SR : can SPLDV.

P : Okay. But did you know that it is included in SPLDV?

SR : I know.

As for the indicator, the ability to describe examples and counterexamples of the subject concept can meet the indicators. The subject was able to name an example from SPLDV but the subject had difficulty when asked the reason for answering the example. The subject is able to answer the reason, but the answer given is not clear. It can be observed that students' understanding of concepts can also affect mathematical reasoning skills. This indicates subjects with low mathematical reasoning skills as well as low understanding of concepts.

Discussion

Based on the results of the analysis that has been conducted, that understanding concepts has a great influence on students' mathematical reasoning skills in solving PISA questions on change and relationship content. Students who are accompanied by a good understanding of concepts tend to be better at reasoning. Research (Almarashdi & Jarrah, 2023) shows that students with a strong understanding of concepts will be able to develop, apply, and understand mathematics to address issues in different real-world situations. In line with the realized study (Bahar et al., 2020) stated that students who have a strong understanding of logic tend to be better at making guesses, manipulating mathematics, providing evidence, and drawing clear conclusions. They can meet all the indicators of

mathematical reasoning exactly. Besides that, they are also able to convey concepts in different forms of representation and use them appropriately in solving problems.

In the research conducted (Agustin, 2016), subjects with high proficiency were able to correctly identify mathematical situations, design the problem solving process smoothly, solve problems appropriately using various structured efforts and draw logical conclusions correctly. Then in the research conducted by (Irianti, 2020), students with high reasoning skills were able to digest problems, string problems, and solve them systematically. They can write information into mathematical models, through elimination and substitution methods, and check answers even when the answers are unwritten. This shows that they have a good understanding and problem-solving strategy.

On the other hand, students with an understanding of concepts that are currently experiencing some obstacles in their reasoning skills, especially in drawing conclusions and restating a concept correctly. Although students have adequate conceptual understanding, they often still face difficulties in developing mathematical reasoning (Säfström et al., 2024). This is related to the assessment (Rukhmana, 2021) proves that students accompanied by conceptual understanding are often experiencing difficulties in their reasoning skills, especially when drawing conclusions and restating concepts appropriately. They may understand some concepts, but still face challenges in connecting them in problem-solving. As a result, even though they can use some reasoning strategies, there are often still mistakes in coming up with solutions. In line with research from (Buyung, 2021) although they may understand some concepts, they still have difficulty applying them thoroughly in problem solving.

Students with low conceptual comprehension are more difficult to reason. They are often confused in understanding the relationships between numbers or variables, making it difficult to make guesses or perform mathematical manipulations correctly. When trying to give reasons for their answers, mistakes often occur because of the lack of understanding of the concepts used. As a result, they have difficulty formulating solutions systematically and tend to make mistakes in answering questions. In the research conducted (Irianti, 2020), students who have low reasoning skills are unable to plan and digest problem solving correctly. Students are not able to solve various steps accurately and correctly. In checking the answers, students have not been able to match the answers with what is in the question.

In PISA questions related to content change and relationship, understanding concepts is highly essential because students need to understand how a change affects other things. If students have a good understanding of concepts, students will easily recognize patterns, choose appropriate solutions, and formulate logical answers. In other words, the better the understanding that students have of a concept, the higher their mathematical reasoning skills when solving problems well.

CONCLUSION

Based on the results and discussion of the realized assessment of students' skills in mathematical reasoning and concept understanding in solving PISA questions related to the content of change and relationship obtained by subjects in the category of mathematical reasoning ability and high concept understanding can solve problems well and achieve all indicators of mathematical reasoning. Subjects can also understand concepts in depth and apply them in various forms of representation and systematic problem-solving. Subjects with the category of mathematical reasoning skills and moderate concept understanding can solve problems quite well, but still have difficulties, especially in drawing conclusions. In addition, the subject still had difficulty in restating the concept clearly despite being able to answer most questions related to concept understanding.

Meanwhile, subjects with the categories of mathematical reasoning ability and low concept understanding experienced difficulties in the dynamics of solving problems correctly and in a structured manner. Subjects cannot satisfy the indicators for mathematical reasoning and concept understanding so they often experience errors in planning and drafting problem solving. This shows that understanding concepts is so important to influence the process of students' mathematical reasoning ability in solving PISA questions on the content of change and relatioship.

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