
Analysis of Student's Error Concept in Solving Questions on The Rank Material

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Abstract

This study is aimed to describe the students' errors in the concept of resolving the question about rank material with descriptive qualitative method. The subject of this study was 21 students at SMA Kisten Kapan in X MIPA A in the academic year 2020/2021. The instruments were test questions, interview sheets, and documentation. Data analysis in this study is data reduction, data presentation and conclusion drawing/verification based on the Miles and Huberman model. The validity of the data was tested using the technical triangulation method. The data analysis result showed that concept errors were conducted by students on the rank material such as a). Students were not able to understand the symbol and place value; b). Students were erroneous in solving process; c). Misinterpreting the idea in writing systematically; d). Students made the error mathematical model and formulate problems' strategies. The most dominant concept error made by students was that students were not able to understand the symbol and place values because they were less careful in working on the questions. The teachers' role in overcoming these problems was to provide various activities in learning mathematics and provide varied practice questions that students learned independently.

Keywords: Errors, Concept, Rank Material

INTRODUCTION

Mathematics is a study material that has abstract objects and is built through a deductive reasoning process, namely the truth of a concept is obtained as a logical result of the previous truth so that the relationship between concepts in mathematics is very strong and clear (Umbara, 2017:13). In this case, the inductive reasoning process can be carried out at the beginning of learning and then continued with the deductive reasoning process to strengthen the understanding that students already have.

Mathematics learning is a process of building students' understanding of facts, concepts, principles and skills according to their abilities, teachers or lecturers deliver material, students with their respective potentials construct their understanding of facts, concepts, principles and skills as well as problem solving (Hamzah and Murlisrarini, 2014:259). One of the objectives of learning mathematics in secondary education based on the Regulation of the Minister of Education of the Republic of Indonesia No. 22 of 2006 is to understand mathematical concepts, explain the interrelationships between concepts and apply concepts or algorithms in a flexible, accurate, efficient, and precise manner in problem solving. Based on this opinion, learning mathematics should be emphasized to achieve a learning goal, namely by showing an understanding of the mathematical concepts being studied because the ability to understand mathematical concepts is very important in learning mathematics.

Lestari and Yudanegara (2015:81) define that the ability to understand mathematical concepts is the ability to absorb and understand mathematical ideas. Hanifah and Abadi (2018) state that concept understanding is the level of ability that expects students to be able to understand known concepts, situations and facts and be able to explain in their own words according to their knowledge, without changing the meaning. Understanding concepts in learning mathematics is important so that students do not experience difficulties in learning mathematics. Therefore, students must master the basic ability, namely the ability to

understand concepts. The results of previous studies show that there are still many students who make mistakes in translating or writing mathematical concepts, this error is made so that students make conceptual errors in working on questions on the rank material.

Rank is one of the most important mathematical material in addition to several other branches of mathematics. Rank is one of the materials that students learn at the high school level. Ranking material is one of the materials where students make a lot of mistakes in solving problems. Even though this material is a prerequisite material in studying mathematics at the next level.

Based on the results of observations at Kapan Christian High School, it was found that there are still many students who have difficulty working on rank questions so there are many types of errors made by students in working on rank questions, namely arithmetic operations errors, symbol writing errors and errors in applying properties. This is supported by the results of student work shown in Figure 1 and Figure 2.

1. Sederhanakan bentuk dari $(a^2 \times a^5)^2 : a^4$
menggunakan sifat-sifat perpangkatan

Jawaban

$$\begin{aligned}(a^2 \times a^5)^2 : a^4 &= (a^{2 \cdot 2} \times a^{5 \cdot 2}) : a^4 \\ &= (a^4 \times a^{10}) : a^4 \\ &= a^{4+10+4} \\ &= a^{18}\end{aligned}$$

Figure 1. Student Work Results 01

1. Sederhanakan bentuk dari $(a^2 \times a^5) : a^4$
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Jawaban

$$\begin{aligned}(a^2 \times a^5)^2 : a^4 &= a^{2 \cdot 2} \times a^{5 \cdot 2} : a^4 \\ &= a^4 \times a^{10} : a^4 \\ &= a^{4+10} : a^4 \\ &= a^{14} : a^4 \\ &= a^{14-4} \\ &= a^{10}\end{aligned}$$

Figure 2. Student Work Results 02

Based on the results of student work in Figure 1. shows that student 01 has not been able to work on the problem correctly because students do not understand the properties of ranks so students can make several types of conceptual errors, namely students make arithmetical errors, misunderstand symbols and incorrectly apply concepts. the nature of the rank so that the results obtained are also not correct. Figure 2. shows that student 02 understands the problem so that the use of the properties of ranks used is correct but is still wrong in using the properties of ranks so that there are several types of errors made, namely conceptual errors and arithmetical operations errors. Therefore, it can be concluded that the results of the work of the 2 students were still wrong in using the concepts in the ranking material.

Solving rank problems requires a deeper understanding of concepts to make it easier for students to solve math problems. Students make mistakes in solving rank problems. Lack of understanding of concepts will result in students making mistakes in solving rank problems. These errors need to be identified through the analysis process so that they do not have an impact on other materials. This study aims to examine the conceptual errors made by students in solving problems on the rank material.

RESEARCH METHODS

The research method used in this study is a descriptive qualitative method that aims to find out students' conceptual errors in solving questions on the ranking material in class X, SMA Kristen Kapan academic year 2021/2022, North Mollo District.

The research instrument is in the form of a ranking material test question in the form of a description and interview guide. The data collection technique used in this study was in the form of a test of understanding mathematical concepts on the rank material, semi-structured interviews and documentation. Data analysis in this study is data reduction, data presentation and conclusion drawing/verification based on the Miles and Huberman model. Testing the validity of the data in this study can be done with four criteria for examining the data, namely internal validity (credibility), external validity (transferability), reliability (dependability) and objectivity (confirmability). The validity of the data was tested using a triangulation technique that aims to check the validity of the data, namely by comparing the results of tests, interviews and research documentation.

RESULTS AND DISCUSSION

Based on the results of the analysis of student work, there are several types of conceptual errors made by students in completing the concept understanding test questions on the rank material, namely not being able to understand symbols and place values, mistakes in the completion process, writing that cannot be read and errors in making mathematical models as well as formulating settlement strategies, that shown in Table 1.

Table 1. Analysis of Student Concept Errors

Concept Error	Number of Students (Persons)	Percentage
Unable to understand symbols and place value	13	62%
Error in the process of completion	7	33%
Misinterpretation of mathematical ideas in writing	6	29%
Mistakes in making mathematical models and developing a solution strategy	10	48%

Table 1 shows that all students made one or more types of conceptual errors. The most dominant type of conceptual error made by students in solving mathematical concept understanding test questions was not being able to understand symbols and place values 62%. This is because students do not understand the concept of the nature of ranks so they are wrong in applying the rank operation as shown in Figure 3.

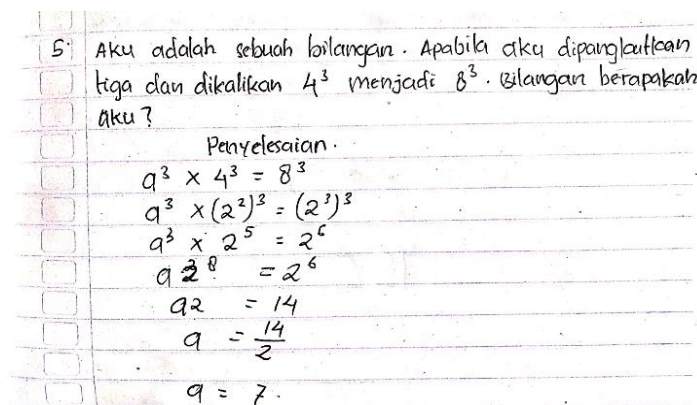


Figure 3. Student Work Results D01

This is confirmed by the results of interviews conducted with D01 as follows:

- J : Is question number 5 difficult?
 D01 : Not too hard.
 J : But D01 made an error, namely still miscalculating and misunderstanding the symbol and place value in the last step of the completion step. Why did D01 make this mistake?
 D01 : I forgot so confused
 J : Confused on which part?
 D01 : I'm getting confused from $a^3 \times (2^2)^3 = (2^3)^3$ I'm confused to proceed to the next step.
 J : Why are you confused?
 D01 : I'm confused because I don't know what operation sign I should use to operate on the exponents of each base number.
 J : Okay, then for the next step why is it still wrong in determining the value of a?
 D01 : I don't know.

Based on the results of student work and interviews, it was found that students made conceptual errors, namely error calculations, unable to understand symbols and place values because they forgot the concept of rank so they were confused in doing the next step. This is in accordance with the results of Sukmana and Arhasy's research (2019) which states that conceptual errors in mathematics will result in weak mastery of prerequisite material before moving on to the next material.

Another error made by students is that they are wrong in the process of 33 % where students are wrong in the process because students only memorize concepts without understanding each concept, causing students to find it difficult to solve problems. The error is seen in Figure 5.

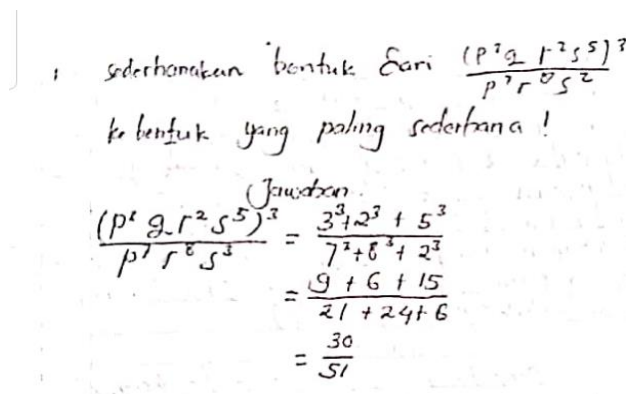


Figure 4. Student Work Results D15

This is supported by the results of interview D15. The interview transcript is as follows:

- J* : *Ok then, is the question given difficult?*
D15 : *It's hard.*
J : *What difficulty did D15 have on the question number?*
D15 : *All about.*
J : *But on the answer sheet D15 it can be seen that there is 2 number of questions to be worked on, namely numbers 1 and 2. Is the answer D15 correct?*
D15 : *That's riht.*
J : *Ok. If so, how about D15's understanding of rank material?*
D15 : *My understanding of the concepts in the rank of material I memorize all the properties.*
J : *Try to mention the properties of the rank of matter!*
D15 : *The properties of ranks that I memorized are $a^m \times a^n = a^{m+n}$, $a^m : a^n = a^{m-n}$, $(a \times b)^m = a^m \times b^m$, $(a^m)^n = a^{m \times n}$, $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$, $a^0 = 1$, $a^{-n} = \frac{1}{a^n}$ and $a^n = \frac{1}{a^{-n}}$,*
J : *Yes, these are indeed the properties of ranks, but why is it that D15 can't solve the problem properly?*
D15 : *I don't understand the meaning of every step.*
J : *Ok then D15 must understand every trait that has been mentioned then D15 will not be difficult to solve the problem.*
D15 : *Yes.*
J : *Oh, so for question number 1, what is the process so that you get the results $\frac{30}{51}$?*
D15 : *To be honest, all the questions that I solved did not match the concept because all the questions were difficult for me because I did not know the completion process so on the answer sheet I wrote down what I was thinking at that time.*

Based on the results of the interview, it was proven that D15 was able to memorize all the properties of ranks but was unable to understand every trait so D15 made an error, namely being wrong in the process of completing each given question. This is supported by the results of research by Rismawati and Asnayani (2019) which states that students' weak understanding of concepts is due to misunderstanding the questions so that they are wrong in the process and wrong in doing the questions because they forget in the process. In addition, Sukmana and Arhasy's research (2019) states that students have not been able to identify the type of questions so students make mistakes when working on the questions, namely not understanding and applying good concepts.

One of the conceptual errors made by students in writing that cannot be read by 33 % where the completion process carried out by students on the answer sheet is not directed according to the concept. The error can be seen shown in Figure 6.

2. Jika $a = 6$, $b = 4$, $c = 3$. maka tentukanlah hasil dari ab^3c^2 !

Jawaban.

diketahui: $a = 6$, $b = 4$ dan $c = 3$. hasil dari ab^3c^2 !

$a = 6$, $b = 4 \times c = 3$ ab^3c^2

$= 6 - 4 = 2$

$= 3 \times 2 = 6$

$= 9$

Figure 5. The work of D02 students.

This is supported by the results of the interview D02. The interview transcript is as follows:

- Okay, is the question given difficult?
A little difficult
- 02
- What difficulty did D02 experience in question number?
Numbers 3, 4, and 5.
- 02
- D02 sure that numbers 1 and 2 are not difficult?
Not sure
- 02
- Why?
The answers on the answer sheet, I believe, are not appropriate and are not directed according to the concept.
- 02
- Why isn't it right?
Because what I wrote on my answer sheet was topsy-turvy, mother, it is possible that other people who read it would also not understand my writing strategy because it was not directed.
- 02
- Oh yeah, indeed, the answer on D02's answer sheet is not quite right because D02 made a mistake, that is, he still misunderstood the symbols and place values, and made a mistake in the completion process so D02's writing could not be read. As a result of what?
Actually what I have in mind is that I understand the question, but when I write the answer, I find it difficult because I don't understand the concept.
- 02
- Okay fine.

Based on the results of the interview, it was proven that D02 had not been able to understand the nature of ranks so D02 made a conceptual error, namely misunderstanding the symbols and place values so that the complete process of solving the test questions was also not by the concept and was not directed so that the writing could not be understood. This is to the results of Sukmana and Arhasy's research (2019) which states that students make internal errors because students are confused by the use of formulas that match the existing questions. This type of error usually occurs because students do not understand the material or students have not been able to understand the concepts of the questions given.

Error in making mathematical models and error in formulating problem strategies, namely one of the conceptual errors made by students by 48% where the completion process carried out by students on the answer sheet is still wrong in changing story questions to form a

mathematical model and also wrong in the process of formulating problem solving strategies. The error can be seen shown in Figure 7.

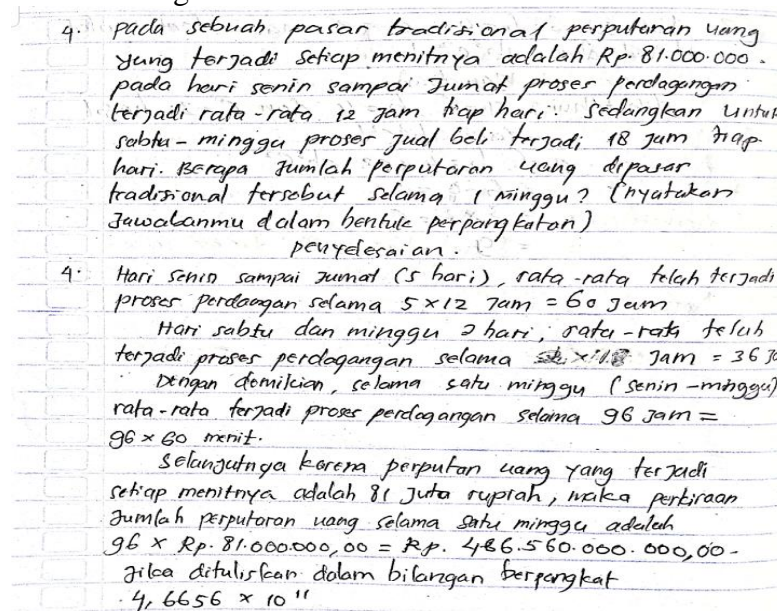


Figure 6. Student Work Results D13

This is supported by the results of interview D13. The interview transcript is as follows:

- J : If so, for question number 4, D13 has answered but still made mistakes, namely making a mistake in making the mathematical model and in the strategy formulation process, why?
- D13 : I am confused about making the problem into the form of a mathematical model.
- J : Okay, after being led to create a mathematical model and enter into problem-solving strategies, can D13 do it or not?
- D13 : , I can't, unless I'm guided by one step for a problem-solving strategy, I can continue on my own.

Based on the results of interviews with D13 students, it was proven that D13 made a conceptual error, namely incorrectly interpreting the answers to mathematical sentences because students were still wrong in converting the questions into mathematical models and were also still wrong in formulating problem solving strategies. Students do not understand the meaning of the question and the flow of the implementation of the settlement strategy. This is supported by the results of Jana's research (2018) which says that errors in language interpretation are due to not understanding the storyline of the question as a whole, resulting in misunderstandings and misunderstandings.

Errors made in solving problems on this rank material need to be minimized, therefore the teacher must overcome conceptual errors made by students, namely paying attention to students who have difficulties in learning, giving assignments and exercises that vary so that students learn independently, and easily in understanding the concept. In addition, an in-depth explanation of the concept of rank and its properties is needed before entering into the example of problem solving. This is the opinion of Andriani, Suastika and Sesanti (2018) that the human mind has an important role to understand a concept and mastery of concepts in mathematics as a form of application of the concept.

CONCLUSION

Based on the results of the analysis and discussion of the research results, the researchers can conclude that the students' conceptual errors in solving the mathematical concept understanding test questions there are several conceptual errors made by students, where the most dominant conceptual error is that students are unable to understand symbols and place values of 62 %. Other conceptual errors were also made, namely errors in making mathematical models and formulating strategies by 48%, writing that cannot be read by 29%, and errors in the completion process by 33%. These mistakes were made by students because students were only able to memorize concepts but did not understand the meaning of each concept, misunderstood the problem so that the process was wrong, wrong in working on the problem because they forgot in the process, did not concentrate and were not careful in working on the problem.

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