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DIFFERENCE OF MISTAKES REFLECTIVE – IMPULSIVE STUDENTS IN MATHEMATICAL PROBLEM SOLVING

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ABSTRACT

Mathematics is one of the important subjects in realizing the goals of education in Indonesia. However, in reality there are many students who have different problem solving abilities between one and the other and many students make mistakes when solving problems. The mistakes that are often carried out by students can also be influenced by differences in learning styles possessed. Therefore this article aims to describe differences in errors made by reflective-impulsive students in solving mathematical problems. This research is a qualitative descriptive that involving 2 research subjects with each subject having a different learning style. This research was conducted in class VII Pakusari Jember 1 Junior High School in the academic year of 2018/2019. The results of data analysis showed that differences in mistakes made by junior high school students with reflective-impulsive learning styles in solving mathematical problems were located at the stage of determining mathematical models and at the stage of completing mathematical models that had been made with the percentage of impulsive learning styles when compared to a subject that is reflective learning style.

Keyword: Differences, mistakes, reflective - impulsive, problem solving

INTRODUCTION

Mathematics has become one of the subjects used by the government to realize educational goals in Indonesia. This can be seen in the implementation of the National Final Examination which must be followed by every student who will complete each level of basic education where Mathematics becomes a compulsory subject which is always tested at the UAN implementation every year, coupled with Indonesian, English and Science subjects

Natural¹⁹ In the mathematics learning, problem solving is an important thing to be achieved by students. This ability requires the existence of complex abilities possessed by students because "Solving problems includes the ability to understand problems, design mathematical models, complete models and interpret solutions obtained" (BNSP 2006). In addition, in the problem solving process students need to have an understanding and knowledge of adequate material, and have a variety of strategies that can be chosen when facing different problems (Zevenbergen in Ulya, 2015). But in its application, most students often make mistakes in solving the problems they face. This matter can be caused by ignorance of the concept by the subject, because to understand the meaning of the questions that have been presented by the subject must master the material and know the concepts related to the problem (Mulyadi, 2015: 372).

In the article he wrote, Tadda (2016: 349) explained that there were three types of the mistakes made by students during solving mathematical problems, which included (1) conceptual mistakes, namely the inability of students to solve questions that were in accordance with their prerequisites, (2) algorithmic errors / procedure, namely the non-

hierarchy between the steps in solving a problem or the inability of students to manipulate the steps they use, and (3) technical mistakes, namely students experiencing mistakes in the computing process or using incorrect notations and students using incorrect the nature of the operation. Whereas another opinion stated by Wijaya in Utami (2017) states that "the location of errors is defined as part of solving problems that occur irregularities. The location of the error is 1) The mistakes in understanding the problem, 2) The mistakes in making plans or mathematical models, 3) The mistakes in implementing or completing mathematical models and 4) The mistakes in writing or stating the final answer to the question". So that based on some of these opinions allows for a lot of mistakes that will be made by students during the problem solving process takes place. This will be a serious problem that must be paid more attention by educators because "Mathematical difficulties in elementary school will continue into secondary school, even affecting subsequent adult life" (Lerner in Novriyani, 2017), so it is very likely that the difficulties encountered by students will continue it keeps repeating even worse if it's not immediately given the best solution. Difficulties in resolving mathematical problems that are repeated for students will also be able to cause students to experience anxiety about mathematics learning during school because Lerner (2006) argues that Mathematical difficulties have certain characteristics, namely difficulties in processing information, difficulties related to language and reading skills, and mathematical anxiety.

Solving their own problems according to Siswono (2008: 36) states that problem solving is a process or effort of an individual to respond to or overcome obstacles or obstacles when an answer or method of answer seems unclear. So that when solving mathematical problems supervision must always be done by considering the decisions and actions taken in analyzing and exploring the condition of the problem, planning in the implementation of the action, selecting and regulating the strategy (Marchis, 2011). So that in solving problems, students will need significant effort and are required to be able to reflect on them in their minds. Tambychik (2010) stated that the problem solving process is starting from the minute students is faced with the problem until the end when the problem is solved.

The problem solving abilities carried out by students are also influenced by the learning styles that each of them has. As revealed by Waskitoningtyas (2017: 36) in his research which found results that learning styles significantly influence students' problem solving abilities. Basically the ability of students to understand and absorb a learning concept will certainly have different levels. The difference in the result from cognitive behaviors and students motor skills not only comes from individual differences and age, but can also be seen based on their cognitive style (Kagan, Rosman, Albert & Phillips in Rosey, 2010). Therefore, students often find different ways to understand the same information or material. This is consistent with what Dunn & Dunn said (in Sugihartono, 2007: 53) because "Learning styles are personal characteristics that make learning effective for some people and ineffective for others". In addition, according to Nasution (2008: 93) states that "learning styles are the way students react and use stimuli they receive in the learning process". Whereas according to Bobbi DePorter and Mike Hernacki (2011: 123) explained that "Learning style is a combination of how someone absorbs and then organizes and processes information". So as we have stated above, in this case it is very possible if students who have different learning styles will also do a different thing or action from one another which makes it easier for them to be able to receive and understand the information given to them in accordance with characteristics that they have. For example, there are students who learn by listening, some learn by reading, experimenting, doing practicum, or by doing other activities. Because "cognitive style as stable attitudes, preferences, or habitual strategies that determine individual's modes of perceiving, remembering, thinking and problem solving" (Messick dalam Kozhevnikov, 2007).

One learning style that tends to be very easily found and observed by teachers is a reflective and impulsive learning style. Rozencwajg & Corroyer (2005) found that the frequency of students who tended to be reflective-impulsive learning styles in the class was 76%. The research conducted by Warli (2010) also reinforces this opinion that the frequency of children with reflective learning styles and impulsive learning styles in the classroom is 73% when compared to other types of learning styles. Kagan (in Faisal, 2011: 6) suggests that someone who has an impulsive learning style will use alternative solutions in a short and appropriate way to select something, they use a very short time to respond to something but tend to be wrong in answering because they do not use many alternatives. While students who have a reflective learning style will be very careful before responding, they will consider many things and make use of many alternative solutions. The time used is also relatively long because it has to consider various alternatives that might be used but the mistakes made will be relatively smaller. So that the cognitive style will provide insight into how students control and manipulate the learning context (Code and Nicholas, 2006).

Based on research conducted by Risqiana (2018) it was found that information that there were differences in the mistakes of the problem solving process carried out by students with different learning styles. In the study mentioned that the subject is distinguished based on Reflective learning style and impulsive learning power. The results of Risqiana's study (2018) showed that in students with reflective learning styles, subjects did not make mistakes in understanding questions and making mathematical models but subjects made mistakes when completing mathematical models and stated the final answers to the questions. Whereas in students with impulsive learning styles, subjects make mistakes in understanding questions, making mathematical models, completing mathematical models and stating the final answers to the questions. So in this article we will discuss more about the differences in mistakes made by students with reflective learning styles and students with impulsive learning styles in solving mathematical problems.

RESEARCH METHODS

This research is included in descriptive qualitative research which aims to describe the differences in errors made by students with reflective learning styles and students with impulsive learning styles in solving mathematical problems in the material of two-variable Linear Equation Systems (SPLDV). The subjects in this research consisted of one student who had a reflective learning style and one student with an impulsive learning style chosen from 34 students of class VII-C Pakusari 1 Junior High School located in Jl. KI Hajar Dewantara, Pakusari District, Jember Regency in the academic year of 2018/2019.

The method of data collection used in this research include the method of giving a test consisting of a learning style categorization test and a problem solving test as well as a semi-structured interview method based on the results of the problem solving work by the research subject. Data in this research in the form of written answers obtained from the results of problem solving tests by the subject and interview transcripts based on the results of interviews conducted by researchers in accordance with the subject's work. The written test is in the form of a descriptive test which is done twice with one question each. The written test used in this study is a problem solving test that is given to each subject alternately, at different times twice and is monitored during the process. After the completion of the written test, the researcher conducted a semi-structured interview process based on the results of problem solving that had been done by the subject which aims to dig deeper about the expected information that has not been revealed through the results of the written test. The results of the interviews that have been obtained are then processed into a form of interview transcript in order to facilitate the data analysis process, while for the sequence of data

analysis performed include data reduction activities, data presentation and conclusion drawing

RESULTS AND DISCUSSION

Tests are given to students who have taken and followed the entire learning process for material in the Two Variable Linear Equation System (SPLDV). The test given is in the form of a description test in the form of solving problems in the material of the Two Variable Linear Equation System (SPLDV). Based on the results of solving problems that have been done by students, the data obtained are as follows:

Mistakes Indicator	Reflektive Subject	Impulsive Subject
a. The mistakes In Understanding The Question		
1. The mistakes determine what is known from the problem Students are categorized as making this mistake if students:		
a) Do not write down what is known.	-	√
b) Not complete writing what is known.	-	-
c) Wrong writing what is known.	-	-
2. The mistakes determine what is asked in the question Students are considered to make this mistake if students:		
a) Not writing down what was asked in the question,	-	√
b) Not complete writing down what was asked in the question,	-	-
c) Wrong in writing what was asked in the question.	-	-
b. The mistakes In Making Mathematics Models Students are considered to make this mistake if:		
a) Not writing a sample variable used in modeling,	-	√
b) It is not complete to write the example of the variable used in making the model,	-	-
c) Wrong in writing a sample variable used in making a model,	-	-
d) Not writing mathematical models,	-	-
e) Mathematical models that are made are not in accordance with the understanding of the problem.	-	√
c. The mistakes Completing Mathematics Model Students are considered to make mistakes if students:		
a) Do not use mathematical rules in completing the model,	-	-
b) Wrong in using math rules,	√	-
c) Do not completing the math model made,	-	-
d) Wrong in completing the math model made.	√	√
d. The mistakes in the first-point event of students is considered to make this mistake, if:		
a) Does not write the final answer,	-	-
b) Incomplete write the final answer,	-	-
c) Wrong in writing the final answer.	√	√

Table 1. Comparison of errors made by reflective and impulsive subjects

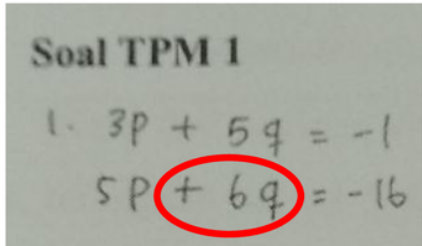
Based on the results of students' work during the mathematical problem solving process presented by the author in the table above, it appears that there are differences in mistakes made by students with reflective learning styles with students who are impulsive learning styles as follows:

1. The mistakes in Understanding Questions ¹²

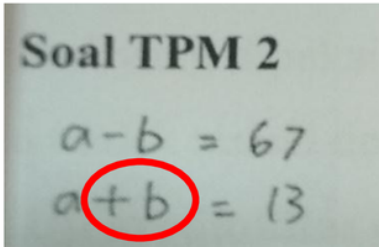
At the stage of understanding the ¹²blem, students with reflective learning styles are able to complete this stage well. Reflective learning style students are able to write and explain correctly what is known and asked about the problem. As for students with reflective learning styles, students make mistakes in terms of not writing what is known and asked about the questions. This is obtained from the results of the answers to the results of the students' work with impulsive learning styles that are seen to directly carry out the second step, namely making an example or mathematical model of the problem being given and from interview results stating that subjects with impulsive learning styles admit that they did not write what which is known and asked in the question because it wants to finish quickly and he claims he has understood the question well so that he feels no need to rewrite it.

2. The mistakes in making mathematical models

At this stage, the difference is seen that subjects with reflective learning styles do not make mistakes in making mathematical models that they will use to solve the problems given. Conversely, in subjects with impulsive learning styles again made mistakes in making mathematical models.



(a)



(b)

Figure 1. The mistakes of impulsive subjects in making mathematical models

The image is the result of problem solving by ¹¹impulsive subjects on the question "There are two numbers, three times the first number plus five times the second number is equal to -1, while five times the first number is reduced by six times the second number is equal to -16. Then the completion of a two-variable linear equation system is ... "for the question in figure (a) and "The number of two numbers is 67 while the difference is 13. If a fraction of the number is made with a small numerator, then the denominator of that number is ... "for the question (b). From the figure, it can be seen that the subject with impulsive learning style makes a mistake by not writing or mentioning the variable used and saying that he does not need to make variable examples but the subject directly writes the mathematical model and the example is done in the mind. The subject of argument is that he is accustomed to working in this way and the subject considers that this method is the most quick and easy way to solve the questions given. Furthermore, errors at this stage are also seen from errors in writing algebraic operations that are used when the subject makes a mathematical model as a solution to the problem given. On the results of the written test it appears that the subject uses an algebraic summation operation when it should use an algebraic reduction operation.

This stage is the second stage where most students make many mistakes. Because Novriani (2007: 63) states that "Percentage of problem solving ability of students in the indicators of problem solving problem was 84.62%, the indicator planning was 61.54%, the indicator of the plan performance was 39.74%, and the confirmation of the answer indicator was 32.05% ". According to Ibrahim (1997), there are two procedural steps in problem solving: i) transforming the problem into mathematical sentences, and ii) computation of the operational involvement in the mathematical sentences. In the other ways, Garnett (in Nathan et al, 2002) said that Incomplete mastery of number facts, weakness in computational, inability to connect aspects of math, inefficiency to transfer knowledge, difficulty to make meaningful connection among information, incompetency to transform information mathematically, incomplete mastery of mathematical terms, incomplete understanding of mathematical language and difficulty in comprehending and visualizing mathematical concepts might result in difficulties. These could lead to making various errors and confusion in the process of problem solving. So that the ability to transfer information that exists in a question into a mathematical statement is very important here which can be a reason for students to make mistakes.

3. The mistakes in completing mathematical models

Still with the same question as in the previous stage. At the time of solving the problem at this stage, the mistakes were made by the two research subjects. But each one has a different mistakes. This time a subject with a reflective learning style made a mistake while doing an algebraic reduction operation.

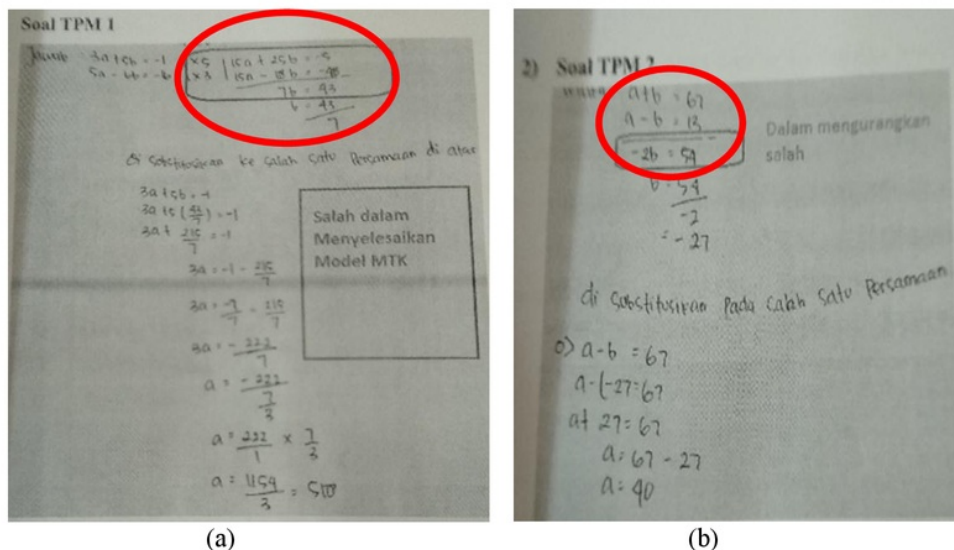


Figure 2. Error in reflective subjects in completing mathematical models

Based on the image, it can be seen that the reflective subject is not careful when performing number operations in the elimination method. This resulted in an error also in solving the mathematical model he had chosen to solve the problem. In Figures 2 (a) and 2 (b), it can be seen that the reflective subject experiences an error when performing an algebraic form reduction operation. The answer written in Figure 2 (a) is $25b + 18b = 7b$ even though the answer should be $25b + 18b = 43b$ and the same error is also shown in Figure 2 (b), that is $b + b = -2b$ when it should be $b + b =$

2b. Errors that exist at this stage are in accordance with the results of Tamchik's research (2010) which states that based on the findings of the data obtained "Showed that respondents lacked in many math skills such as number-fact, visual-spatial and information skills". The other ways, "Computational skills and their mastery are necessary but a sufficient component of problem solving. Students who cannot carry out basic computations will have difficulty solving problems" (Kaur, 1997).

Whereas in subjects with impulsive learning styles, errors at this stage lie in errors in completing mathematical models that have been made. This is the impact of previous mistakes made by the subject at the stage of making a mathematical model as a solution to problem solving which is the second stage in the problem solving process. Because "Successful problem solvers planned their solutions in more detail before carrying them out than unsuccessful solvers, who tended to be impulsive in executing a solution without a complete understanding of the problem" (Foong, 1994).

4. The mistakes in stating the final answer to the question. The mistakes in stating the final answer to the question are both done by both subjects in the form of mistakes in writing the final answer. The second error is caused by an error that has been made in the previous stage which directly causes a subject error in determining the final answer to the problem that has been given.

By paying attention to the description of the results of descriptions of various kinds of errors that have been made by reflective subjects and impulsive subjects above. Then we will be able to find the key point that caused the two subjects to make mistakes. For subjects with reflective learning styles, mistakes are made when completing the mathematical model that has been made. In this case the reflective subject is considered inaccurate in carrying out integer counting operations which causes the subject to be wrong in the process of elimination. Whereas in subjects with impulsive learning styles, the main mistake is made when he is making a mathematical model that will be used to find solutions to the problems that have been given. Errors made by impulsive subjects in making mathematical models to solve this problem can lead to successive errors at the stage of completing a mathematical model and state the final answer to the problem solving problem. So that it can be seen that the mistakes made by impulsive subjects are more compared to the mistakes made by reflective subjects. This fact is in accordance with the statement put forward by Liew-onn, et al (2011) which states that impulsive cognitive style is a character of the cognitive style students have in solving problems with a short time but less accurate so that they will produce answers that tend to be wrong. While reflective children are children who tend to respond in a long time to a problem but tend to be more accurate because they first consider many alternatives before responding so that it is high probability that the response given is correct (Philip et al in Qomaroh, 2013). So, Kilpatrick (1985b) also considered that "problem solvers' ability to reflect on their own cognitive processes would bring to consciousness an awareness of their emotional reactions to problem solving".

CONCLUSION

Based on the data analysis of the results of the research and discussion that has been conducted done above, then we can conclude that the difference in errors made by junior high school students with reflective-impulsive learning styles in solving mathematical problems lies in the stage of determining the mathematical model and the stage of completing the mathematical model. Reflective subjects actually do not experience errors when determining a mathematical model to get the solution to the problem, but the reflective subject makes a

mistake in carrying out the addition and subtraction operations that result in errors in stating the final answer to the problem solving problem. While the impulsive subject made a mistake at the stage of determining the mathematical model that resulted in subsequent errors when completing the mathematical model and stated the final answer to the problem solving problem given.

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