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ANALYSIS OF STUDENTS ERROR IN WORKING ON STORY PROBLEMS BASED ON NEWMAN'S CRITERIA IN CLASS XI MIA 3 MAN 3 PADANG

Fajar Surya [1], Sofia Edriati[2], Alfi Yunita[3]
[1,2,3] Mathematics Education, PGRI University, West Sumatra
fajarman0514@gmail.com

Info article

Abstract

The background of this research is that there are still many students who are less interested and motivated in learning mathematics so that many students make mistakes in solving math word problems. The purpose of this research is to identify and identify the types of mistakes made students in working on word problems based on Newman's Error criteria and knowing the causes of students making mistakes In doing story problems.

The research method used is descriptive method with a qualitative approach . The sample of this study were 24 students of class XI MIA 3. The research instrument was tests and interviews. The test results were analyzed based on Newman's criteria, after which students were interviewed based on the types of mistakes made by students.

The results of this study indicate that the types of errors made by students based on Newman's criterion analysis consist of 5 errors, namely Reading errors, Comprehension errors, Transformation errors, Process Skill errors and Endcoding errors. The biggest mistake was made at the stage of writing the final answer, namely as much as 46.67%, while the smallest error was made at the stage of understanding the questions, namely as much as 5.33%.

INTRODUCTION

Mathematics is a field of study that plays an important role in education. It can be seen from the study of mathematics from elementary to middle school and even to college. Besides that, it is also emphasized in Permendiknas No. 22 of 2006, mathematics subjects need to be given to all students starting from elementary school to equip students with the ability to think logically, analytically, systematically, critically and creatively as well as the ability to cooperate with students. According to Suherman in (Komariyah, et al, 2018) , "Mathematics taught in primary and secondary education is school mathematics".

Based on Permendikbud Number 22 of 2016 regarding the objectives of learning mathematics, namely: (a) understanding mathematical concepts, describing how the interrelationships between mathematical concepts and applying concepts or logarithms efficiently, flexibly, accurately, and precisely in solving problems, (b) reasoning the pattern of properties of mathematics, developing or manipulating mathematics in constructing arguments, formulating evidence, or describing mathematical arguments and statements, (c) solving mathematical problems which include the ability to understand problems, construct models of mathematical solutions, complete mathematical models, and provide appropriate solutions, and (d) communicate arguments or ideas with diagrams, tables, symbols, or other media in order to clarify the problem or situation. *The National Council of Teaching Mathematics* (NCTM) formulates the objectives of learning mathematics in schools as follows: (1) mathematical communication; (2) mathematical reasoning; (3) problem solving; (4) mathematical connections; and (5) mathematical representation. It can be concluded, learning mathematics aims to hone students' mathematical abilities in solving problems related to mathematics by thinking critically and logically and being able to apply them in everyday life.

The achievement of learning goals in mathematics can be seen from the learning outcomes of students. To be able to achieve good learning outcomes, students are required to be able to solve questions correctly. But in reality students still find it difficult to solve math problems, resulting in students making mistakes in solving math problems. The mistakes that students usually make in solving math problems are understanding concepts that affect arithmetic operations so that they will have an impact on the results of solving math problems done by students.

In the learning process students are often faced with problems in order to test the abilities of each student. One form of the problem that is often given is a matter of story. According to (Hartini, 2008) word problems are a form of questions that present problems in everyday life in the form of narratives or stories. In fact, students think that word problems are difficult and mistakes often occur in solving word problems. According to Wahyuni in (Marlina, 2013) the low ability of students in working on word problems can be seen from the many mistakes students make when working on story problems. According to Lusianadalam (Suciati & Wahyuni, 2018) the mistakes made by students can result in a decrease in students' scores in mathematics. In order to achieve optimal learning outcomes, teachers need to know the mistakes students often make in working on math word problems. According to (Lestari et al, 2018) an analysis of the mistakes made by students is needed to solve problems and can help students in solving math word problems. Mathematics is very important subject to study because mathematics is inseparable from everyday life.

One way to be able to analyze the mistakes made by students in solving math word problems is by using analysis based on Newman's criteria. Newman's criterion suggests five stages that can help analyze errors made while solving math word problems, namely: reading errors *, comprehension* errors *, transformation errors *, process skills *errors.*), and final answer writing errors (*encoding errors*).

Based on the results of observations made on September 27 to 8 October 202 1 in MA N 3 Padang City , in the process of learning mathematics it can be seen that students are less active in the process of learning mathematics. Students are busy with their own activities that are not related to mathematics. Students only listen, pay attention, and take notes on the material presented by the teacher. It can be seen from one of the students' daily test answers in Figure 1.

Figure 1. Example of Student Daily Deuteronomy

In Figure 1, it can be seen that students have not been able to solve a problem correctly. Based on the students' answers above, students seem unable to make good and correct answers in solving the problems of the story questions.

Based on the results of observations on June 29 2022 at MAN 3 Padang, there are still many students who are less interested and motivated in learning mathematics and this causes student achievement to be less than optimal. This is evident from the results of the daily tests of students who are still under the minimum completeness criteria (KKM) set by the school, namely 80.00. From class X MIA 1-4, X MIA 3 class has the most scores below the KKM. With the same number of students in each class, namely 30 people, X MIA 3 students whose grades were above the KKM were only 12 people. This proves that students still make many mistakes in solving word problems. And from these follow-up observations the students had gone up to class XI MIA which were then re-selected for class XI MIA 3 as research subjects by the researchers.

Based on the results of interviews with the obligatory mathematics teacher for class XI MIA 3 MAN 3 Padang, information was obtained that some students made many mistakes when working on story problems, where students experienced a lot of confusion in understanding the questions and connecting them with the material they had learned and many were also origin answer because you do not understand the meaning of the question. This resulted in students experiencing many mistakes when working on word problems. Based on this information, it is necessary to do an analysis of student errors to find out, identify, and describe clearly what mistakes students made. Based on the results of the interviews above, it is necessary to conduct an in-depth analysis of the mistakes made by students in working on word problems. By identifying the mistakes made by students, the writer can find out the types of errors such as mistakes in writing answers. Identification of the types of student errors in working on the questions, the author uses the Newman criteria guide to make it easier to identify the types of errors made by students from each step of the student's answers. If mistakes in solving problems are allowed, the learning objectives cannot be achieved. Newman's criterion is one of the guidelines for analyzing the types of errors made by students in working on math problems.

Based on this description, the writer feels the need to identify student errors in working on word problems, which the author will examine in a study entitled: **"Analysis of Student Errors in Working on Story Problems Based on Newman's Criteria in Class XI MIA 3 MAN 3 Padang"**

RESEARCH METHODS

The type of research used in this research is descriptive research using a quantitative approach which aims to reveal a symptom as it is. This research is carried out in the odd semester of the 2022/2023 school year. Place of implementation of this research in MAN 3 Padang. This study aims to find out and identify the types of mistakes made by students in working on word problems based on Newman's Error criteria and to find out the causes of students making mistakes in working on word problems. The subjects of this study were students of class X MIA 3. The research instruments were tests and interviews.

In this study, the data to be analyzed were daily data or processes in student learning on the test instrument in the form of story questions. Analysis of the test answers is to find out where the mistakes made by students in working on word problems. In analyzing errors based on Newman's criteria, the indicators presented in the following table are needed:

Table 2. Newman Criterion Error Indicators

No.	Error Type	Indicator
1.	Error reading problem (*reading error / re*)	Students are not able to find keywords from questions or difficult terms in questions.
2.	Error understanding the problem (*comprehension error/ ce*)	Students are not able to find out what is known and what is asked in the problem.

3.	Error transformation problem (*transformation error/te*)	Students are unable to make mathematical models, and do not know what formulas to use, and students do not know what operations to use in solving problems.
4.	Error process skills (*process skill error / pse*)	Students do not know the procedure used to complete the operation correctly
5.	Answer writing error (*endcoding error/ee*)	Students are able to solve problems correctly, but students do not conclude the solution into mathematical sentences

Source: (Fitritien, 2019)

RESEARCH RESULTS AND DISCUSSION

RESEARCH RESULTS
     The research was conducted on class IX MIA 3 MAN 3 Padang students in the even semester of the 2022/2023 school year, a total of 23 students. The questions given at the time of the test aim to find out the types of mistakes made by students in solving the questions. The test consisted of 2 questions and was carried out for 45 minutes which was attended by 23 students.
     Errors in the results of students' test answers on functional derivative material are grouped into 5 based on Newman's error indicators:

Table 4 . Percentage of Error Types of Final Test Questions

ERROR TYPE	QUESTION 1	QUESTION 2	PERCENTAGE
Reading errors (RE)	12	1	17.33 %
Comprehension error (CE)	3	1	5.33 %
Transformation error (TE)	20	7	36 %
Process Skill error (PSE)	8	5	17.33 %
End coding error (EE)	20	15	46.67 %

     Based on Table 4, it can be seen from the results of calculating the percentage of errors made on the type of error in reading the questions *(Reading error)* obtained 17.33%, errors in understanding the questions *(Comprehension error)* obtained 5.33%, process transformation errors *(Transformation error))* obtained 36%, errors in process skills

(Process Skill error) obtained 17.33%, and errors in writing the final answer *(Endcoding error)* obtained 46.67%.

DISCUSSION

      The results of the research were carried out on 25 students of class XI MIA 3 MAN 3 Padang by providing 2 essay questions that had been completed by students in solving math problems on the matter of derivative functions based on Newman's error indicators.

Student error on question number 1

      Based on the error analysis that had been carried out, 3 students were taken with different types and variations of the location of the errors, namely ADS, FZ and AK students for interviews. The following are the results of the analysis of student errors in working on test questions:
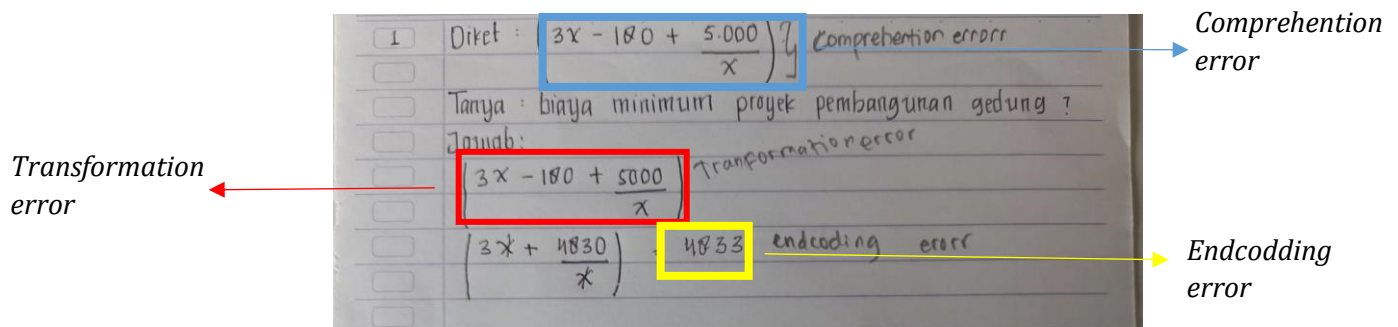
Figure 3. ADS student answer sheet

      Figure 3 shows that ADS students made several mistakes, namely *the Compretion error* , where the important information known in the questions the students misunderstood, then *the Transformation error* the students made wrong in determining the formula and wrong in the solving steps.

      Based on the results of the interviews conducted, information was obtained that students experienced errors (1) *Comprehension errors* , namely students were confused in writing what was asked in the questions, (2) *Transformation errors* , namely students were wrong in writing formulas, (3) *Process Skill errors* and (4) *Endcoding error* , namely students do not know the calculations and final results that they have done are right or wrong.

Figure 4. Answer sheets of FZ students

Figure 4 shows that FZ students made several mistakes, namely *the Transformation error* where students did not write down important information in the questions and students also made mistakes in determining the problem solving formula. Next *Endcoding error* , namely students are wrong in writing the results of the settlement and the conclusion.

Based on the results of the interviews conducted, information was obtained that students experienced errors (1) *Transformation errors* , namely students were not careful in making formulas, and (3) *Endcoding errors* , namely students made mistakes in doing calculations so that students were wrong in making conclusions, because students didn't notice the error.

Figure 5. Student AK's answer sheet

Figure 5 shows that AK students made several mistakes, namely *Comprehension errors* , namely mistakes in determining what was asked in the questions where students wrote the questions incorrectly into their mathematical form. The next is that the students incorrectly determine the formula, and are wrong in determining the steps for completion. Finally, that is wrong in operating calculations where students are wrong in multiplication operations and do not make conclusions .

Based on the results of the interviews conducted, information was obtained that students experienced errors in (1) *Comprehension errors* , namely students were not careful in determining what was asked in the questions, (2) *Transformation errors* because students did not pay attention to the results of the answers, and (3) *Process Skill errors* namely the student is wrong in the calculation operation.

Based on the results of the analysis of the data obtained, it can be concluded that the students' errors in question number 1 were ADS students making mistakes *(Comprehension errors)* , *(Transformation errors)* , and *(Endcoding errors),* then FZ

students made mistakes *(Transformation errors)* , and *(Endcoding error)* and AK students make mistakes *(Comprehension error)* , *(Transformation error)* , and *(Process Skill error).*

Student error in question number 2

Based on the error analysis that had been carried out, 3 students were taken with different types and variations of the location of the errors, namely MAF, NSA and VP students for interviews. The following is an analysis of student errors in working on test questions:
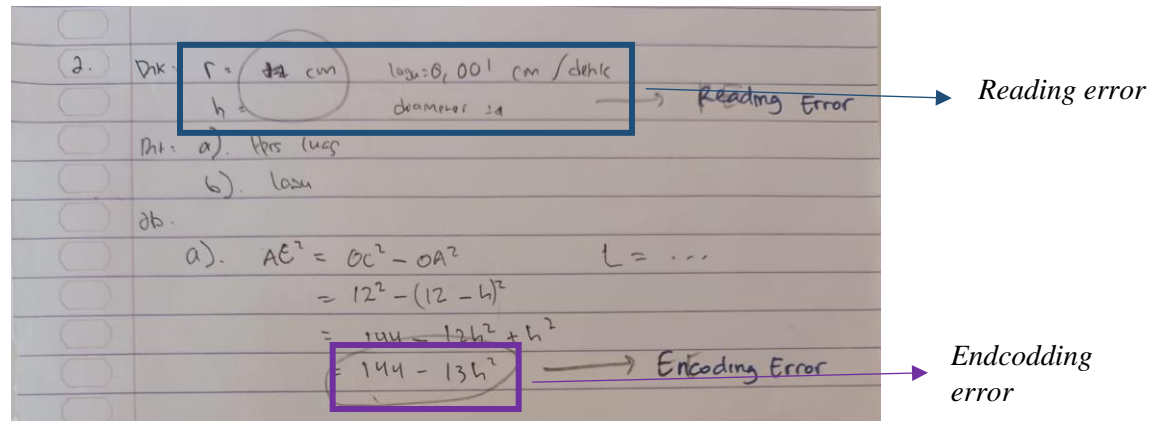

Figure 6. MAF student answer sheet

Figure 6 shows that MAF students made mistakes, namely *Reading errors* , students made mistakes in reading important words or information in the questions and *(Endcoding errors)* mistakes in writing the final answer, where there was a step error that affected the final result of the answer itself and not make a conclusion.

Based on the results of the interviews conducted, information was obtained that students experienced errors (1) *Reading errors* , namely students were wrong in reading important words or information in the questions, (2) *Endcoding errors* , namely students did not know the calculations and the final results they had done were correct. or wrong.
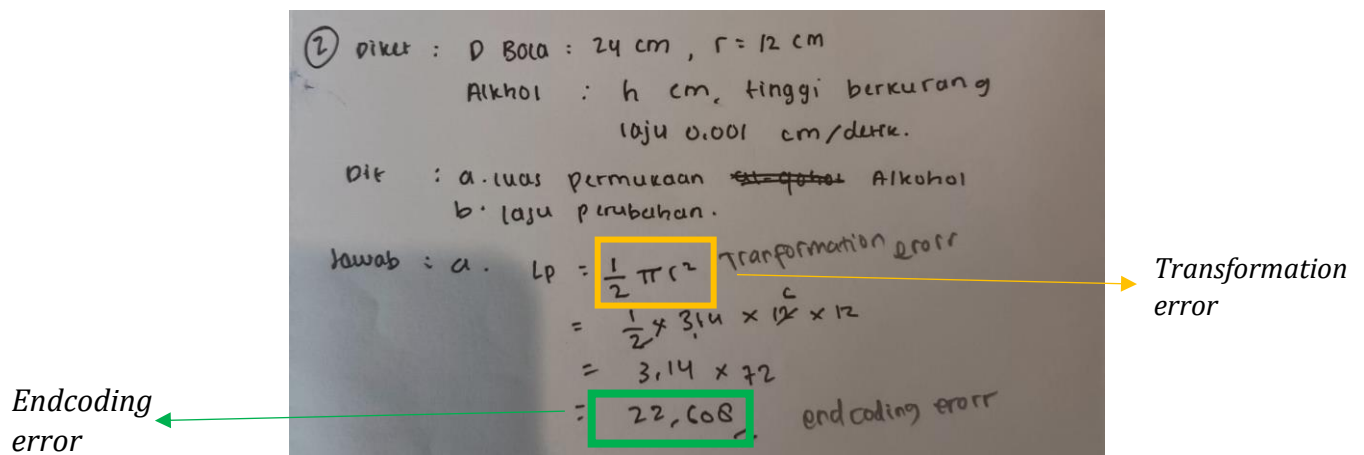

Figure 7. NSA student answer sheet

Figure 7 shows that the NSA students made several mistakes, namely *the Transformation error* where the NSA was wrong in determining the formula used, namely the NSA did not write down the complete formula used, and the *Endcoding error* , which was wrong in multiplying the final results of the answers and not making conclusions.

Based on the results of the interviews conducted, information was obtained that students experienced errors (1) *Transformation errors* , namely students were not careful in making formulas, and (2) *Endcoding errors* , namely students were wrong in multiplication and were not used to making conclusions.

Figure 8. Student answer sheet VP

Figure 8 shows that VP students made several mistakes, namely *Process Skill errors* , namely errors in operating calculations, namely errors in multiplication operations. Finally, and *Endcoding error* , namely students are wrong in writing the final answer and do not draw conclusions.

Based on the results of the interviews conducted, information was obtained that students experienced errors (1) *Process Skill errors* and (4) namely students did not know the calculations and final results that they had done were right or wrong.

Based on the results of the analysis of the data obtained, it can be concluded that the students' errors in question number 2 were MAF students making mistakes *(Reading errors)* , and *(Endcoding errors),* then NSA students made mistakes *(Transformation errors)* , and *(Endcoding errors)* and students VP made an error *(Process Skill error),* and *(Endcoding error).*

The results of data analysis for the 2 questions with several students that have been done, it can be seen that each error and the factors that cause students to make mistakes are as follows:

1. Errors in reading questions *(Reading error)*

    At this stage reading errors occur when students misread terms, symbols, words or important information in the problem. This is because students are less careful in reading the questions. This is in accordance with research conducted by (Rahmawati & Permata, 2018) which revealed that in reading errors students still

experience errors in interpreting sentences correctly and errors in reading symbols and important information in questions. This is also in line with what was stated by (Daswarman, 2020) which stated that reading errors were due to students not paying close attention to the questions.

2. Error in understanding the problem *(Comprehension error)*

Errors in understanding occur because students do not understand the information and students cannot determine what is known and what is asked in the problem. This is in line with research (Rahmawati & Zhanty, 2019) which states that student errors occur because the process of interpreting the information given into mathematical expressions is not quite right. This is also in line with research conducted by (Darmawan et al, 2018) which revealed that errors occurred because students could not say what was known and what was asked in the questions.

3. Error in process transformation *(Transformation error)*

Errors in the transformation process occur because students incorrectly determine the formula used and students incorrectly determine the steps for completion. This is in accordance with what was stated (Magfirah et al, 2019) where transformation errors occur because students cannot determine the appropriate formula. This is also in line with what was expressed by (Dinnullah et al, 2019) which stated that students were wrong and unable to determine the right steps in solving the questions given.

4. Error in process skills *(Process Skill error)*

Errors in process skills occur because students are wrong in operating calculations. This is in line with (Sumadiasa, 2014) which states that student inaccuracy causes errors in arithmetic operations. This is also in accordance with what was expressed by (Haryati et al, 2016) which states that process skill errors are errors in performing calculations, such as errors in multiplication or addition and errors in performing algebraic operations.

5. Error in writing the final answer *(Endcoding error)*

This error occurs because the student is wrong or not quite right in writing the final answer. This is in line with what was stated by (Sudiono, 2017) that students make mistakes in the final answer if the student is able to do the completion correctly but does not write the conclusion of the final answer or is not appropriate in concluding the final answer. Furthermore, (Santoso et al, 2017) really regretted the mistake in writing the final answer because students had succeeded in reaching the completion or data processing stage but failed to write the final solution.

CONCLUSION

Based on the results of data analysis and discussion, it can be concluded that, in solving math problems, the material for the derivative function based on Newman's error analysis consists of 5 errors, namely errors in reading the questions *(Reading error)* , errors in understanding the questions *(Comprehension error),* errors in the transformation process *(Transformation error),* error in process skills *(Process Skill error)* and error in writing the final answer (*Endcoding error).* The biggest mistake was made at the stage of writing the final answer, namely as much as 46.67 % , while the smallest error was made at the stage of understanding the questions, namely as much as 5.33%.

Based on the results of the interviews conducted, information was obtained that students experienced errors based on Newman's criteria described below.

1. *Reading errors* , namely students are wrong and not careful in reading important words or information in the problem.
2. *Comprehension errors* , namely students who are not careful, forget and are confused in writing down and determining what is known and asked about the questions because they are in a hurry to do the work.
3. *Transformation error* , namely students do not pay attention to the formula that has been made, then students are not careful, forget, doubt and are confused in using the right formula, besides that students forget, are confused and do not know the steps in solving the problem. *Process Skill error*, namely students have not mastered addition and multiplication operations, and students are not careful and in a hurry in carrying out the calculation process.
4. *Process Skill error*, namely students have not mastered addition and multiplication operations, and students are not careful and in a hurry in carrying out the calculation process.
5. *Endcoding error* is the result of previous errors in the calculation process and students are in a hurry to work on the final answer.

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