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ANALYSIS OF SCHOOL ERRORS OF CLASS VIII SMP NEGERI 19 PALU IN RESOLVING THE STORY OF PYTHAGORAS THEOREM BASED ON NEWMAN THEORY

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Abstract

This study aims to describe the types of errors made by students in solving Pythagorean theorem story problems based on Newman's theory. This type of research uses descriptive research with a qualitative approach. Data collection was done by tests and interviews. The type of data in this study is qualitative data, namely a description of the types of student errors in solving Pythagorean theorem story problems based on Newman's theory. The subjects of this study are three students from SMP Negeri 19 Palu's VIIIA class. The results of this study indicate that students' errors in solving Pythagorean theorem problems in class VIIIA are 1) Comprehension Errors, namely students are unable to understand what is known and what is asked and students do not know what is known and what is asked according to the problem request 2) Transformation Errors, namely students do not write down the formula used, and students are unable to determine the correct formula in solving the problem. 3) Process Skill Errors, namely students do not write down the formula used, and students are unable to determine the correct formula in solving the problem. 3) process skill errors, namely students are unable to perform the procedures or steps used correctly, and students have not been able to perform the correct calculation process. 4) answer writing errors, namely students are unable to write the final answer from solving the problem, students are unable to write and explain the final answer in accordance with the intended conclusion of the problem.

Keywords: Error analysis, Pythagoras theorem, Newman theory.

Abstrak

Penelitian ini mencoba untuk mengkarakterisasi jenis-jenis kesalahan yang dilakukan siswa ketika mencoba menyelesaikan soal-soal naratif yang melibatkan teorema Pythagoras dengan menggunakan teori Newman. Penelitian deskriptif dengan menggunakan metode kualitatif digunakan dalam penelitian ini. Data dikumpulkan melalui wawancara dan ujian. Penelitian ini menggunakan data kualitatif, khususnya mendeskripsikan berbagai macam kesalahan yang dilakukan siswa ketika mencoba menyelesaikan soal cerita yang melibatkan teorema Pythagoras dengan menggunakan teori Newman. Tiga siswa dari kelas VIIIA SMP Negeri 19 Palu menjadi subjek penelitian. Hasil penelitian ini menunjukkan bahwa kesalahan siswa dalam menyelesaikan soal teorema Pythagoras kelas VIIIA adalah 1) Kesalahan memahami masalah *(comprehension errors),* yakni siswa tidak mampu memahami apa saja yang diketahui dan apa yang ditanyakan dan siswa tidak mengetahui apa yang diketahui dan apa yang ditanyakan sesuai permintaan soal 2) Kesalahan transformasi *(transfomation errors),* yaitu siswa tidak menuliskan rumus yang digunakan, dan siswa tidak mampu menentukan rumus yang benar dalam menyelesaikan soal. 3) Kesalahan keterampilan proses *(process skill errors),* yaitu siswa tidak mampu melakukan prosedur atau langkah-langkah yang digunakan dengan benar, dan siswa belum mampu melakukan proses perhitungan yang benar. 4) Kesalahan penulisan Jawaban *(enconding errors)* yaitu siswa tidak mampu menuliskan jawaban akhir dari penyelesaian soal, siswa tidak mampu menuliskan dan menjelaskan jawaban akhir sesuai dengan kesimpulan yang dimaksud soal.

Kata kunci: Analisis Kesalahan, Teorema Pythagoras, Teori Newman.

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INTRODUCTION

Mathematics learning in the 21st century challenges teachers to always innovate in optimizing the quality and quality of learning in the classroom (Purwasih, 2020). Mathematics is an important and compulsory subject to be taught from elementary school to college, because learning mathematics can equip students with the ability to think logically, analytically, systematically, critically, and creatively, as well as the capacity to work together. Besides, it is also a source of other sciences, in other words, many sciences whose discovery and development requires mathematical science, so that maths subjects are very useful for students as basic sciences for applications in other fields (Sholihah & Mahmudi, 2015). It is important that students in schools learn mathematics as it may help them become more logical, critical, and analytical. Mathematics is a science that deals with abstract concepts, abstract concepts are one of the characteristics of mathematics (Rahma, 2018). The problems that occur in everyday life that relate to matters/concepts of mathematics are given to students in the form of stories (Rudyanto, 2017). Story problems train students to think analytically, because they require understanding and logical reasoning and require understanding between concepts to solve them (Hadaming & Wahyudi, 2022). Students' efforts in formulating a mathematical story are not limited to the immediate results of the topic they are given; rather, they should understand the systematic procedure for formulating a mathematical story based on the steps involved in the process. Errors in solving math problems often occur either in writing or orally (Zakaria, 2010). Pythagoras's theorem is a mathematical material that is widely applied in everyday life. For this reason, it is very important for students to understand and grasp the principles of Pythagorean theory so they won't experience difficulties applying the material in mathematics and daily life.

In fact, at present the concepts and principles of mathematics are not yet well and correctly understood by students, which can lead to a student's mistake in solving the story. Based on the results of interviews with the mathematics teacher of class VIIIA at SMPN 19 PALU obtained information that the average score of students of class VIIIIA on mathematical subjects is still below the maximum. Such errors need to be described, in order to describe the kinds of errors students make in solving questions about the material of Pythagoras's theorem, then a theory needed to be used as an alternative to analyzing the type of error students make at solving issues. As a methodical diagnostic procedure, the Newman theory

is used to analyze student problems in math class, where there are several types of problems: reading error, comprehension error, transformation error, process skill error, and notation error (Karnasih,I, 2015). Newman's procedure can be used to determine the types of students' errors in doing math problems (Suyitno, 2015). The reason candidate researchers are interested in using Newman's theory is because according to the candidate theory it is suitable for the analysis of student errors in working on the form of the story because in this theory there is an indicator of reading error that is to be able to know the student's error position when reading or recognizing symbols, terms or words that are present in the question.

From the students' mistakes in working on the story problem, the researcher considers it important to conduct this research to examine more deeply, one of which is through the analysis carried out on student errors when solving story-shaped math problems so that the teacher can find the right method in planning the learning process needed by students on the concepts of Pythagorean theorem material, improving learning methods and perfecting skills in working on Pythagorean theorem story problems. Based on the description above, the researcher conducted a study on "Analysis of Student Errors in Solving Pythagorean Theorem Story Problems Class VIIIA SMP Negeri 19 Palu based on Newman's theory".

METHODS

This type of research is descriptive research with a qualitative approach. The purpose of research using the type of descriptive research is to obtain an image or description of the student's mistake in finishing a story based on Newman's error analysis. The research was conducted in class VIIIA, which was to distribute a test sheet to students of class VIIIIA about the story of the Pythagorean theorem of two numbers. After giving the test, the researchers selected three students to be the focus of the research to be interviewed. Selection of the three students based on the students who made a lot of mistakes, the mistakes made may represent other students' mistakes.

After the selection of subjects, the researchers conduct interviews on the subject of the study, the type of interview used in this study is semi-structured interviews. This interview is based on the guidelines that the interview has been made. The guidelines used for the interview are just the big lines. The interview in this study aims to boost data on the type of

student error based on Newman's stages. The data analysis technique in this study uses the Milles and Huberman model analysis as cited by Sugiyono (2014), which includes data reduction, presentation (data display), and conclusion drawing / verification. The credibility test carried out in this study is member check. The purpose of member check is to find out how far the data obtained can be used in writing reports in accordance with what the informant means (Sutriani & Octaviani, 2019). Member check is carried out after data collection is complete, or after obtaining a finding or conclusion.

In this study, we used indicators of error types based on Newman's procedures (Suwarno, dkk. 2023), namely: (1) reading errors; (2) comprehension errors; (3) transformation errors; (4) process skill errors; and (5) enconding errors.

Table 1. Neman Error Indicator

Type Of Error	Error Indicator
Reading Errors	• Students make mistakes when reading important words in questions. • Students have mistakes in reading symbols in question
Comprehension Error	• Students don't know what they know about it. • Students don't know what they're asking about. • Students are not good at writing things that are known and asked from the subject. • Students are wrong in identifying information on the subject.
Transformation Error	• The student is wrong in determining the formula to be used to solve the issue.
Process Skill Error	• Students in the use of rules or rules of operation incorrectly. • Error performing

	calculations or calculations • Students do not proceed to the completion stage
Enconding Error	• The student is wrong in writing the final answer • Students do not write final answers

RESULTS AND DISCUSSION

1. Display of RA Test Results and Data Analysis

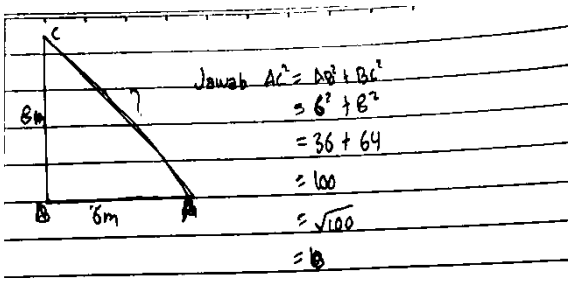

Figure 1. Show RA Test Results for Question 1

Based on the test results of the subject RA in the above image shows that RA does not write what is known and what is asked on the subject, subject is able to write the formula used, subject performs the calculation correctly, RA is also able to get the answer from its calculation properly, but RA did not make the conclusion of the answer that has already been found.

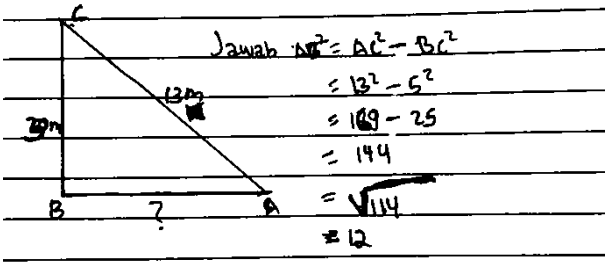

Figure 2. Show RA Test Results for Question No. 2

Based on the test results of the subject RA in the above image shows that RA does not write what is known and what is asked on the subject, subject has been able to write the formula used, the subject has done the calculation correctly, but RA mistakenly wrote the number that is found on the root, RA is also able to get the answer from its calculations correctly but RA did not make the conclusion of the answer that has been found.

a. Reading Errors

Based on the results of an interview with the RA subject on issue number one, the subject is able to read the subject well and can mention the symbols on the subject. So it's concluded that on issue number one, the RA subject has not had a mistake reading the issue. Signs that are well-readable and mention the symbols on the subject. So that on issue number two, the RA subjects didn't have any mistakes reading about it either. So it was concluded on issue number one and issue number two that RA had no reading errors.

b. Comprehension Errors

Based on the written test results of the RA subject on question number 1, the subject does not write what is known and asked on the subject. In the interview quotation the subject is able to accurately mention what is known and what is asked on the subject. In the interview quotation on the question number two the subject is able to mention what is known and what is asked correctly, so that in the questions number one and number two, the subject does not have a mistake in understanding the problem.

c. Transformation Errors

Based on the results of the RA test at number 1, it shows that the RA is able to write the formula used to solve the question. In the interview quotation, the RA subject is capable of mentioning and explaining the formula that is used for solving the question correctly. Then, on the result of the RA subject test on question number 2, it shows that the RA subjects are able to write the formulas used. On the interview quotation the subject is able to mention and explain the formula used to solve the question. So on the question number 1 and on the issue number 2, the subject has no transformation error.

d. Process Skill Errors

Based on the results of the RA test on question number 1, the subject did not experience process errors.While the test results on question number two, there were process skill errors, according to the interview, it was due to writing errors at the time of the issue, so that the subject did not experience process errors.

e. Enconding Errors

On questions 1 and 2, the subjects have enconding errors, i.e. they do not write a conclusion after obtaining the results of their work. Similarly, in the interview quotation, the subject is unable to explain the conclusion of the answer because it does not understand what the conclusions of the answers are, and the subjects are not used to writing that thing at the time of solving the question.

2. Display of LA Test Results and Data Analysis

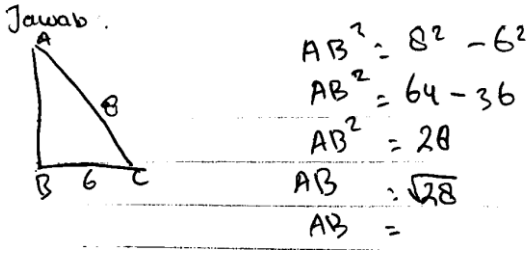

Figure 3. Show LA Test Results for Question 1

Based on the test results of the LA subject in the image above, it shows that the LA does not write what is known and what is asked on the subject, the subject does not also write the formula used, the subjects do not understand the meaning of the subject so that it is wrong to use the operation used, besides the subject did not write the answer of his calculations so that he could not write a conclusion of the answer

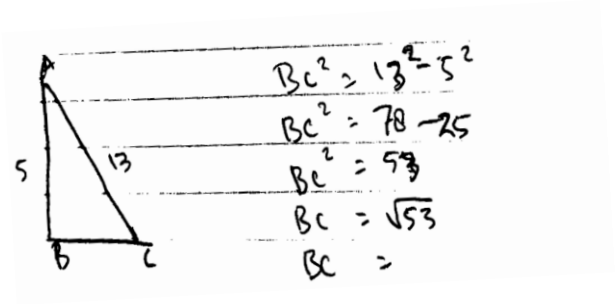

Figure 4. Show LA Test Results for Question 2

Based on the test results of the LA subject in the image above, it shows that the LA does not write what is known and what is asked on the subject, the subject does not also write the formula used, the subjects are also wrong in performing the translation, besides the subject is not writing the answer from its calculations so that it is not able to write the conclusion of the answer

a. Reading Errors

On topics 1 and 2, based on the interview results of the subject, LA is able to read the subject well, besides that LA is also able to recognize the symbols and information contained in the subject.It shows that on questions number one and number two, the subject has no reading errors.

b. Comprehension Errors

what was asked. Based on the results of the interview the subject explained not to write what is known and asked because the subject felt that it was not necessary to write it, at the time asked to explain what was know and what is asked the subject could not correctly illustrate about the form of mathematics. It indicates that the subject has made a mistake in understanding the problem. The same applies to the test results on question number two, and it appears that the subject does not write what is known and what is asked. But based on the interview with the subject on question number two, the subject is able to explain what is known and what is correctly asked. It shows that the subject did not make a mistake understanding the problem.

c. Transformation Errors

On the results of the LA test on question number one, the LA subject did not write the formula used to solve the question, the L.A. subject directly performed the process of solving the question. Based on the interview, the subject was wrong in determining the correct formula to be used to solve the question. On the interview quotation the subject is wrong in explaining the formula used, due to not understanding the meaning of the issue. It shows that the LA subjects made a transformation mistake. On the result of the LA test on question number two, the subject directly performed the calculation process without writing the formula used first.In the interview quotation on issue number two, the subject explains that he did not write the formula because he was in a hurry, but at the time he was asked to mention the formula, he could mention it correctly. It shows that the LA subjects did not make a transformation mistake.

d. Process Skill Errors

In the case of tests number 1 and 2, the L.A. subjects made a process skill error, which is, they made a calculation error, besides, the subject did not complete the performance process to get the final result. In the result of the interview, the subject is silent only when asked

about the miscalculation, then the subject explains that he did not continue his work because he didn't know the end result of his performance process. Tests on questions 1 and 2 showed that the LA subjects made a mistake in process skills.

e. Enconding Errors

Based on the results of the LA test on question number one, it appears that the subject did not write the conclusion of the final answer. Based on the interview the subject did not write the final answer because the subject didn't get the answer from the process of completing the question. In the interview quotation to the subject on question number two, the subject explains that he did not write the final answer because he didn't get the answer from his performance process. From the tests on questions 1 and 2, it can be concluded that the LA subject made a final answer writing mistake.

3. Display of NN Test Results and Data Analysis

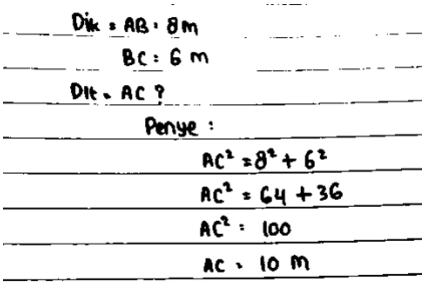

Figure 5. Show NN Test Results for Question 1

Based on the test results of NN subjects in the image above, it shows that NN can write what is known and what is asked on the subject, but NN has not yet written the separation completely. The subject also wrote the formula used, the subject also did the calculation correctly, but the subject NN did not write the conclusion of the answer

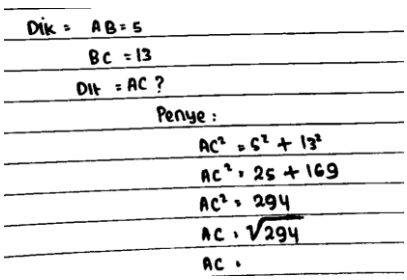

Figure 6. Show NN Test Results for Question 2

Based on the test results of the subject NN in the above image indicates that NN has not yet understood the question correctly, it is apparent that the NN mistakenly wrote what is known, the subject did not write the formula used in solving the question, besides the subject does not write out the results of its calculations, so the subject is unable to write the conclusion of the answer.

a. Reading Errors

Based on the results of the interview on issue number one, the NN subject is able to read the matter well, and can recognize the symbols in the matter. Also, the results of the interview on question number two, the NN subjects can read the subject well, and recognize the symbols that are on the subject. Based on the interview results on the test of questions 1 and 2, show that the subject did not make a reading mistake.

b. Comprehension Errors

Based on the results of the NN test on question number one, it is apparent that the subject writes what is known and what is asked, but the subject does not write a clear description on the symbols used. However, at the time of the interview, the subject is able to explain the correctly used symbols. It shows that the NN subject did not make a mistake understanding the problem. In the case of test number 2, the NN subject has already written what is known and what is asked, but the subject has not written a description of the new symbols used. At the time of the interview on the issue number two, the subject is not yet able to correctly illustrate the matter in mathematical form. It shows that NN's subjects made a mistake in understanding the problem.

c. Transformation Errors

Based on the results of the NN test on question number one, it is apparent that the subject did not write the formula used, the subject directly performed the calculation operation to obtain the result of his work. Based upon the interview, NN explained that the formula was not written because it was forgotten, but the subject could explain the formula correctly used at the time of the interview. It shows that the subject did not make a transformation mistake. On question number two, the subject did not write the formula used.

Based on the interview, the NN subject was wrong in using the formula to solve the question. It shows that the subject makes a transformation mistake.

d. Process Skill Errors

Based on the results of the NN test on question number one, it is apparent that the subject performed the calculation process correctly. It shows that the subject did not make a process error. Based on the results of the NN test on question number 2, it is apparent that the subject did not proceed with the calculation process, in addition, because the subject was wrong in determining the formula used, causing the subject is also wrong in performing the process of elaboration of the question. It indicates that the subject made a process error

e. Enconding Errors

Based on the results of the NN test on question number one, it is apparent that the subject does not write the conclusion of the final answer, the subject only writes up to the answer of the calculation process. In an interview with the NN subject, the subject does not understand what the final answer conclusion is, so the subject doesn't write the final response conclusion. Similarly, the test results of NN subjects on question number two did not write a conclusion of the final answer, based on the interview subject was not written because he did not proceed with the process of drafting the question. Based on the results of the tests and interviews on questions number 1 and 2, showed that the subject made a mistake in writing the final reply.

CONCLUSION

Based on the results of the research and discussion, the following conclusions were obtained: the errors made by SMP Negeri 19 Palu in solving Pythagorean theorem story problems based on Newman's theory were: 1) Comprehension Errors, namely: students were unable to understand what was known and what is asked and students do not know what is known and what is asked according to the question request 2) Transformation Errors, namely students do not write down the formula used, and students are unable to determine the correct formula in solving the problem. 3) Process Skill Errors, namely students are not able to carry out the procedures or steps used correctly, and students are not able to carry out the

correct calculation process. 4) Enconding Errors, namely: students are unable to write the final answer to solving the problem, students are unable to write and explain the final answer according to the conclusion referred to in the question.

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