ERROR ANALYSIS IN SOLVING APPLIED MATHEMATICS PROBLEMS BASED ON THE NEWMAN PROCEDURE

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ABSTRACT

The purpose of this study is to describe the various kinds of errors made by taruna when solving applied mathematics problems based on the Newman procedure. Newman divides errors into 5 types, namely reading error, comprehension error, transform error, process skill error, and encoding error. This research uses descriptive qualitative research methods. Data collection techniques were carried out using tests and interviews. Data reduction, data presentation, and verification or conclusion drawing are part of this research. Based on the results of research and data analysis, it can be seen that in solving mathematical problems in land mathematics courses there are 5% of subjects experience errors in reading errors, 16% of subjects experience errors in comprehension errors, 9% errors in transform errors, 26% of subjects experience process skill errors, and 9% errors in encoding errors. Most of the errors were errors in the selection of problem-solving strategies.

Keywords: *Errors; Applied Mathematics; The Newman Procedure*

ABSTRAK

Tujuan dari penelitian ini adalah untuk mendeskripsikan berbagai macam kesalahan yang dibuat oleh taruna ketika menyelesaikan masalah matematika terapan berdasarkan prosedur newman. Newman membagi kesalahan menjadi 5 jenis, yaitu reading error, *comprehension error*, *transform error*, *process skill error,* dan *encoding error.* Penelitian ini menggunakan metode penelitian kualitatif deskriptif. Teknik pengumpulan data dilakukan dengan cara tes dan wawancara. Reduksi data, penyajian data, dan verifikasi atau penarikan kesimpulan merupakan bagian dari penelitian ini. Berdasarkan hasil penelitian dan analisis data, dapat diketahui bahwa dalam menyelesaikan masalah matematika pada mata kuliah matematika pertanahan terdapat 5% subjek yang mengalami kesalahan pada *reading error*, 16% subjek mengalami kesalahan pada *comprehension error*, 9% kesalahan dalam *transform error*, 26% subjek mengalami kesalahan *process skill error*, dan 9% kesalahan dalam *Encoding Error.* Kesalahan terbanyak terdapat pada kesalahan dalam pemilihan strategi pemecahan masalah.

Kata Kunci: Kesalahan; Matematika Terapan; Prosedur Newman

INTRODUCTION

Mathematics is given to students and it was starting from we are in elementary school to university level to equip them with many ability to think logically, analytically, systematically, critically, innovatively and creatively, and cooperate (Irianti, 2020; Irianti et al., 2016; Siregar, 2019). Mathematics is a broad science that includes arithmetic, measurement, geometry, algebra, statistics, and other branches of science (Damayanti et al., 2017). According to the National Council of Teachers of Mathematics, mathematics learning is given to equip students with creative thinking skills, mathematical reasoning abilities, and useful basic knowledge and skills (NCTM, 2000)(Hiebert, 1999). Sekolah Tinggi Pertanahan Nasional (STPN), which is a university that provides learning focused on the field of land, must equip its taruna, one of which is the science of measurement which is part of mathematics.

At STPN itself, taruna get several courses on mathematics, including Land Measurement Science, Land Statistics and Applied Mathematics. The Applied Mathematics course itself is a compulsory course that must be taught by taruna in the DIV Land study program in semester 1. This course contains the application of branches of mathematics in measurement and mapping activities in the cadastral field.

Taruna frequently makes errors in their mathematical studies, particularly when it comes to problem-solving. Based on researcher observations of taruna in the DIV Land study program, there are still some taruna who make mistakes in applying mathematics to the area field. This is because the mastery of basic mathematical concepts is still lacking, so there are still many errors in mathematical concepts made by taruna.

The existence of errors in learning mathematics is very necessary to be a concern (Ningrum et al., 2022). Students' errors in solving problems need to be identified because the information obtained about students' errors can then be used to improve the quality of mathematics learning and ultimately is expected to improve students' mathematics learning achievement (Munawaroh et al., 2018; Ningsih et al., 2022; Rasul & Trisakti, 2022; Sari et al., 2021).

Several theories can be applied to analyze the mistake made by students when solving tasks. One method for analyzing the mistakes made by students when answering math problems is to apply Newman's procedure (Dariantie et al., 2022)(Rukmana

Yus et al., 2019). Newman error analysis itself is defined as a simple method used to analyze several types of errors in solving mathematical problems (Rohmah et al., 2023)(Dwandaru et al., 2024). There are 5 types of error analysis according to Newman, including students' errors in reading the problem (reading error), students' errors in understanding the problem (comprehension error), errors in transforming the problem into mathematical forms and strategies (transform error), errors in applying the chosen strategy to solve the problem (process skill error), and errors in writing the completion of the final answer incompletely or errors in providing the conclusion (encoding error) (Ananda & Fauzan, 2023; Irianti et al., 2022; Rasul & Trisakti, 2022). Based on this background, this study aims to analyze taruna' errors in solving mathematical problems based on the Newman Procedure.

RESEARCH METHOD

This research is descriptive-qualitative research that aims to describe the mathematical concept errors of taruna in solving mathematical problems. This research was conducted at the DIV Land Study Program of the National Land College (STPN) in the odd semester of the 2023/2024 academic year. The subjects of this study were 1st-semester taruna of class F in the Applied Mathematics course.

This research was preceded by initial observations of taruna at STPN to obtain initial information about the understanding of taruna' mathematical concepts. Furthermore, the researcher prepared an instrument in the form of mathematical problems by the material from the Applied Mathematics course. Then the problem was given to taruna to solve.

Written assessments and interviews were the methods of data collection employed in this research. Interviews were undertaken with students who committed errors in order to pinpoint the problems and identify the reasons behind them. According to Miles and Huberman, this study uses qualitative data analysis, which entails data reductions, data presentations, and finding. In this study, researchers used data triangulation techniques by verifying data from the same source but with different techniques, namely written tests and interviews.

RESULT AND DISCUSSION

In this research, the problem given is the area of a plane. Field area material is one of the materials given in the Applied Mathematics Course. In this material,

taruna apply their knowledge of geometry to solve the problem of Area of Field which is the material that must be mastered by taruna, which is part of measurement.

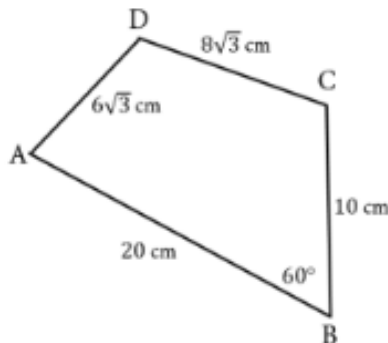Determine the area of quadrilateral ABCD below!

Figure 1. Problem with Area of Field

After the Field Area problem is given, it is then analysed to find out what errors are encountered in solving this Field Area problem. The results of the subject's work based on the 5 Newman Procedure theories are as follows.

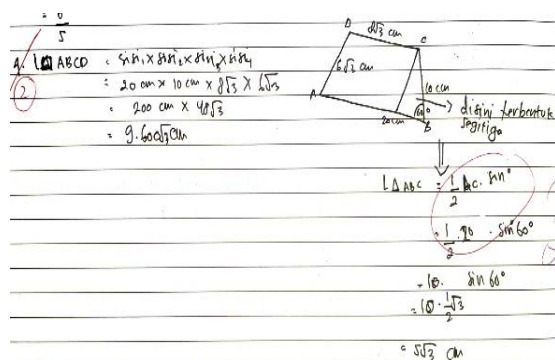1. Error in Reading the Problem (Reading Error)

Figure 2. Taruna's work

Figure 2 above is one of the mistakes made by the subject. There are mistakes made by taruna in reading the problems

given. This can be seen from the picture in the problem which is an arbitrary rectangle, different from the shape of the rectangle given by the taruna.

2. Error in Understanding the Problem (Comprehension Error)
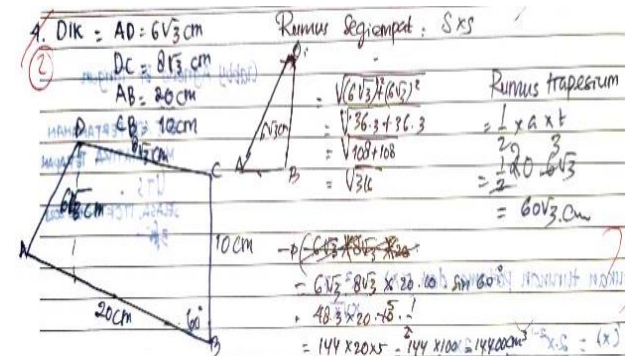

Figure 3. Taruna' work

Figure 3 shows one of the taruna' mistakes in understanding the given problem. The field, which is an arbitrary rectangle, is understood by the taruna as a trapezoidal rectangle. Therefore, the subject looked for the area of the field by first finding the height of the trapezoid. This is supported by the results of the interview with the subject. When the researcher asked how the process of working on the problem given, the subject explained that to find the area of the trapezoids, first by finding t (height) of the unknown trapezoid, then used to find the area by entering it into the trapezoid area formula.

3. Errors in Transforming the Problem into Mathematical Forms and Strategies (Transform Error)
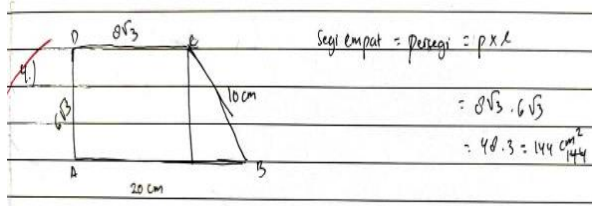

Figure 4. Taruna's work

Errors in transforming the problem were also made by the research subject. This happened when the subject transformed the rectangle in the problem into a square rectangle. The subject transformed one side of the rectangle as p (length) and the other side as l (width).

4. Error in Applying the Strategy Chosen to Solve the Problem (Process Skill Error)
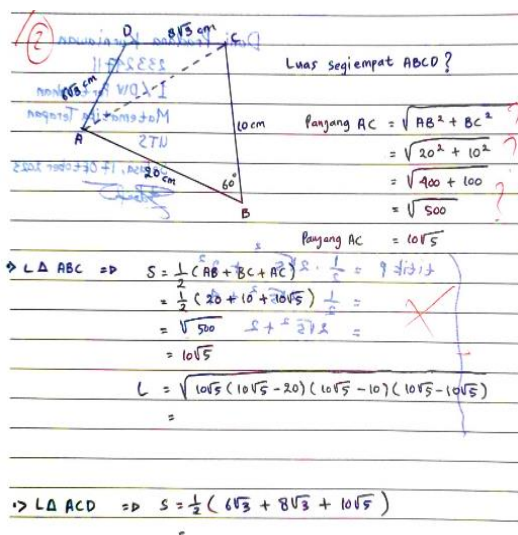

Figure 5. Taruna's work

From Figure 5 above, it appears that the subject has divided the plane into two. The error in the application of the strategy appears when the subject finds the length

$(AC)^{-}$ by using the rule of the Pythagorean theorem, by finding the root of the sum of the squares of the other two sides. There is a conceptual error here that the Pythagorean Theorem only applies to right triangles. This is also supported by the interview results, where the subject used the Pythagorean Theorem for any triangle.

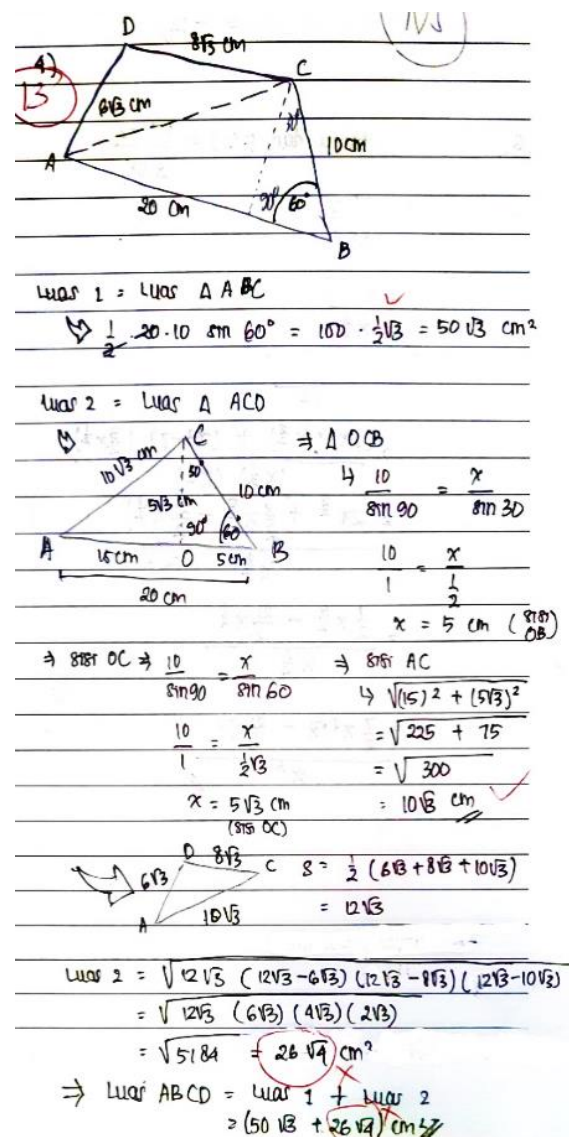5. Incomplete or Errors in Writing the Final Answer or Encoding Error

Figure 6. Taruna's work

The subject made an error in the final calculation as shown in Figure 6 above. The subject made a calculation error in converting $\sqrt{5184}$ into a simpler root form. This caused the final calculation when the subject added the two areas, namely Area 1 and Area 2, to be incorrect.

After analysing the test results of all subjects, it was found that of the 57 subjects studied, 5% subjects experienced errors in reading the problem (reading error), 16% of subjects experienced errors in understanding the problem (comprehension error), 9% errors in transforming the problem into mathematical forms and strategies (Transform Error), 26% of subjects experienced errors in applying the chosen strategy to solve the problem (process skill error), and 9% errors in writing incomplete final answer solutions or errors in providing conclusions (Encoding Error).

Most errors were found in choosing and applying strategies used for problem-solving. The area of field problem, which has a lot to do with the application of geometry, makes it difficult for research subjects to determine the right problem-solving strategy, thus causing errors in the problem-solving process. This is also supported by research conducted by Rasul et al, who found that student errors in

process skill errors are also widely done in solving mathematical problems (Rasul & Trisakti, 2022).

CONCLUSION

Based on research conducted in class F of the DIV Land Study Program in the odd semester of the 2023/2024 academic year, the results show that of the 57 subjects studied, 5% of subjects experienced errors in reading errors, 16% of subjects experienced errors in comprehension errors, 9% of errors in Transform Error, 26% of subjects experienced process skill errors, and 9% of errors in Encoding Error. Most of the errors were errors in the selection of problem-solving strategies.

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