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ANALYSIS OF STUDENTS' ERRORS IN SOLVING PLANE GEOMETRY WORD PROBLEMS BASED ON NEWMAN'S ERROR ANALYSIS (NEA) METHOD

Dinda Sholehah Syawali [1], Ima Mulyawati[2]
[1,2]Universitas Muhammadiyah Prof. Dr. Hamka, Jl. Tanah Merdeka No.20 Rambutan Ciracas District, Jakarta City.
e-mail: ima.mulyawati@uhamka.ac.id

Abstract

This study aims to apply Newman's Error Analysis (NEA) as a method for teaching students to identify mistakes they make when solving word problems involving plane geometry, identify factors that contribute to students' difficulty in understanding mathematical concepts while solving such problems, and determine appropriate strategies to address errors made by students in solving plane geometry word problems. The research used descriptive methodology and is classified as qualitative research. Data was obtained through tests and interviews conducted with four Grade IV students from a public elementary school in East Jakarta who participated in the study as respondents. The students' errors in solving plane geometry word problems using the NEA method were attributed to several factors: lack of attention during class, unawareness of the main issues in the problem, difficulty in selecting appropriate mathematical operations, challenges in executing calculation procedures accurately, and neglecting to review final answers. To address these errors, the research recommends providing practice questions ranging from easy to difficult, using teaching techniques and delivery methods that are easily understood by students, and using a variety of learning methods to accommodate different learning styles among students.

Keywords: NEA, factors causing errors, error handling efforts

Abstrak

Tujuan dari penelitian ini adalah menggunakan metode *Newman's Error Analysis* (NEA) untuk mengidentifikasi kesalahan yang siswa lakukan ketika mencoba memecahkan soal cerita yang mencakup bangun datar, menemukan faktor-faktor yang menjadikan siswa kesulitan memahami konsep matematika ketika mengerjakan soal cerita bangun datar, serta mengidentifikasi upaya yang tepat untuk memperbaiki kesalahan siswa ketika mencoba memecahkan masalah bangun datar dalam bentuk soal cerita. Penelitian ini merupakan jenis penelitian kualitatif deskriptif. Wawancara dan penerapan tes digunakan untuk mengumpulkan data. Empat siswa kelas IV salah satu SD Negeri di Jakarta Timur menjadi responden penelitian. Alasan di balik kesalahan siswa ketika mencoba memecahkan soal cerita berdasarkan NEA adalah kurangnya fokus siswa dalam menerima pelajaran, persoalan inti pertanyaan tersebut tidak dipahami oleh siswa, siswa kesulitan mengidentifikasi atau menerapkan operasi matematika yang perlu diterapkan untuk mengerjakan masalah yang disajikan dalam soal, siswa menghadapi kesulitan dalam menjalankan prosedur perhitungan dengan benar saat mengerjakan soal, dan ketidaktahuan siswa akan perlunya menulis dan memeriksa kembali jawaban akhir mereka. Adapun solusi menangani kesalahan siswa yakni memberikan latihan soal dari yang mudah hingga sulit, guru harus memiliki teknik dan penyampaian pembelajaran yang bisa ditangkap dengan mudah oleh siswa, guru harus kreatif dengan memiliki banyak metode pembelajaran agar bisa menangani bergbagai karakter anak dalam menerima pelajaran.

Kata kunci: NEA, faktor penyebab kesalahan, upaya menangani kesalahan

INTRODUCTION

Mathematics is considered a subject that is always present at every level and stage of formal education, whether at the elementary, secondary, or higher education levels (S. Sirate,

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2012). This is because mathematics is a highly vital discipline, and as such, everyone is required to study mathematics. Fundamentally, mathematics is always relevant and is a necessity in daily activities. Similarly, mathematical word problems affect students' daily routines because they emphasize actual events relevant to situations encountered in daily life. Therefore, word problems serve as an evaluation tool to measure students' understanding of the basic mathematical concepts taught, especially in applying relevant formulas. One can be said to have mathematical ability if they are skilled at correctly solving mathematical problems (Retna *et al.,* 2013).

Mathematics comprises a variety of concepts and methods that are intriguing for problem-solving in each question. However, in reality, students may struggle to fully understand mathematical concepts and methods due to the diverse range of problem concepts and issues encountered. Consequently, students often make mistakes when attempting to solve problems presented in word problems, especially in mathematics problems involving plane geometry. Yet, the purpose of providing word problems is to communicate knowledge and awareness that mathematical knowledge, both in terms of concepts and methods, can be applied in daily life.

Mathematics education at the Elementary School (SD) level is one of the areas that must be developed to stimulate students' interest in learning mathematics. Children at the elementary school age are undergoing development in their thinking and learning approaches (Anggraini, 2021). Therefore, it is important to teach mathematics from the early stages of a child entering Elementary School. Mathematics differs from other disciplines such as social sciences because it is an exact science.

Mathematics has a distinctive abstract nature. For many students, understanding and learning mathematics can be challenging due to these characteristics and factors. There are various reasons why errors occur when solving word problems, including skill factors. Skills are essential elements in solving problems in word problems (Wiranti *et al.*, 2023). As a result, it is not uncommon for students to lack interest or even dislike mathematics learning.

Solving mathematical word problems requires precision and deep understanding. Students often provide inaccurate answers to questions, which is usually due to their inability to read and comprehend the problem well, errors in performing transformations, or even

carelessness. Sometimes, students may perform one or more of the four arithmetic operations (+, -, x, ÷) required to answer the question, but they may not know which operation should be used to solve the problem at hand (Vaiyatvutjamai & Clements, 2004).

To understand the various errors made by students and the reasons behind them, a deep analysis of their answers and the methods used in each error or mistake found is required. In this study, students' errors are analyzed using Newman's Error Analysis (NEA) method. NEA is an abbreviation for Newman's Error Analysis, which is intended as a fundamental diagnostic method to help solve mathematical word problems. The Newman error analysis method was first proposed by Anne Newman, an Australian mathematics teacher, in 1977 (Darmawan *et al.,* 2018). Newman (as cited in white 2010), claims that a child must follow five basic steps to solve written mathematical problems, including: (1) Reading the problem: Students are considered to make errors when reading questions if they struggle to read the question or recognize important symbols or words, and if they cannot interpret the meaning of each phrase, word, or symbol in the problem. (2) Understanding what is read: Students are considered to make errors in solving problems if they cannot articulate the available information and do not understand the question posed in the problem. (3) Transformation: Students are considered to make errors in transforming problems if there is a lack of knowledge about the formulas needed to address the problem raised in the question, a lack of understanding of the arithmetic operations required, or an inability to develop a mathematical model for the given problem. (4) Process Skills: Students are considered to make errors in process skills if they do not understand the method or actions needed to solve the problem, are unable to articulate and execute the required steps or procedures, or are unable to develop a mathematical model for the given problem. (5) Encoding: Based on Singh et al. (2010) "*an encoding error occurred when despite having appropriately and correctly solved a mathematical task, the pupil failed to provide an acceptable written form of the answer".* In simpler terms, even after students have completed solving a mathematical problem, errors can still occur when they are not accurate in expressing the intended concept or answer. Students are considered to make errors if they cannot show the final solution to address the problem or cannot formulate the final answer according to the intended end goal planned in the investigation.

Several researchers who have conducted Newman's Error Analysis (NEA) research include Utari et al. (2019); Mulyadi et al. (2015); Oktaviani et al. (2023). According to Utari et al. (2019), students' learning difficulties can occur at several stages, including difficulties in understanding concepts, skills, and problem-solving. According to Mulyadi et al. (2015) Studying children's spatial abilities in solid figure topics based on the NEA method. Meanwhile, according to Oktaviani et al. (2023) state that students have difficulty understanding plane geometry material because they feel burdened and struggle to memorize plane geometry formulas. However, NEA research for Grade IV independent curriculum plane geometry topics has not been conducted yet.

One of the teaching materials that can be used for word problems is plane geometry. The material to be investigated is plane geometry at the Grade IV level, available in the Grade IV mathematics book Vol 2 unit 12 "Area," which consists of 3 subsections: area of rectangles and squares, and units for large areas. This material is a suitable choice for identifying the types of student errors determined by Newman's Error Analysis (NEA) method because students are usually given questions that are not varied and lack skills in applying formulas and identifying the appropriate plane geometry types to solve problems in descriptive questions. Similarly, mastery of this material is a crucial prerequisite for students to understand lesson themes in subsequent topics.

Based on observational findings during the researcher's internship at one of the elementary schools in East Jakarta, it was found that students made mistakes when answering word problems. As a follow-up, a brief interview was conducted by the researcher with a student who provided inaccurate answers to the given questions. Based on the interview results, the researcher can conclude that the source of these errors is due to the student's inability to understand the importance of the given story questions. Therefore, students have difficulty transforming words into the appropriate numerical model and answering what they know and are asked.

With the explanation provided, it can be concluded that the researcher considers it important to analyze the mistakes made by students when solving mathematical word problems. As a way to understand and identify student errors and the factors influencing them, the researcher will conduct a study to analyze and study these conditions to answer plane geometry word problems. This will be done through a study titled **"Analysis of Student**

Errors in Solving Plane Geometry Word Problems Based on Newman's Error Analysis (NEA) Method."

This research aims to (1) analyze the errors made by fourth-grade students at one of the elementary schools in East Jakarta in the academic year 2023/2024 when solving plane geometry word problems based on the Newman's Error Analysis (NEA) method; (2) identify the factors causing students to misunderstand mathematical concepts when solving plane geometry word problems; (3) identify appropriate efforts to address the errors made by students when attempting to solve plane geometry word problems. Based on the research objectives, it can be concluded that providing plane geometry word problems can help educators identify where students make mistakes, and the factors causing their misunderstanding and errors, thereby enabling teachers to determine the appropriate steps or efforts to address these issues.

RESEARCH METHODOLOGY

Qualitative descriptive research was the method used for this study. Its purpose was to explain research findings related to the research questions, where the data obtained were natural and not manipulated by the researcher. This opinion was in line with the view of Sugiyono (2017), who stated that qualitative research is a type of research aimed at studying natural objects.

The selection of the descriptive approach was based on the consideration that the data collected would be verbal description data from interviews with students who had taken the test. In the test results, errors were found when solving word problems using Newman's Error Analysis (NEA). This data was used to identify the location and factors causing students' errors when solving mathematical problems related to plane geometry material.

Data collection through tests was conducted by providing a test instrument consisting of several questions to gather data on students' abilities, especially in the cognitive aspect (Lestari, 2017). The test method was applied to identify students' scores, error locations, factors causing errors, and appropriate actions to address students' errors when solving plane geometry word problems using Newman's Error Analysis (NEA) method, all of which were carried out through interviews with students. The data analysis technique follows the statement by Miles and Huberman as conveyed by Sugiono. Data analysis activities involve

three simultaneous stages, namely data reduction, data presentation, data verification, and drawing conclusions (Sugiono, 2014).

Task-oriented interviews were conducted with selected subjects at various times and situations in this study to evaluate the validity of data triangulation.

RESULTS AND DISCUSSION

Analysis of Students' Errors in Solving Plane Geometry Word Problems Based on Newman's Error Analysis (NEA)

The final task results obtained by students after working on plane geometry word problems revealed the errors made by students in plane geometry materials based on Newman's Error Analysis (NEA) method. Thus, an analysis was conducted on the students' final results. Based on the students' final results, classification of relevant final results was carried out using Newman's Error Analysis (NEA) method, namely reading errors, comprehension errors, transformation errors, skill process errors, and encoding errors. The details of various categories of student errors are presented in the following table.

Table 1. Types of Student Errors

No	Error Type	% of Students Making Mistakes	
		Female	Male
1	a. Reading errors	-	-
	b. Comprehension errors	-	12.5%
	c. Transformation errors	10%	-
	d. Process skills errors	60%	12.5%
	e. Final answer writing errors (encoding errors)	30%	12.5%
2	a. Reading errors	-	-
	b. Comprehension errors	10%	6.25%
	c. Transformation errors	10%	6.25%
	d. Process skills errors	50%	18.75%
	e. Final answer writing errors (encoding errors)	30%	25%
3	a. Reading errors	-	-
	b. Comprehension errors	30%	12.5%

No	Error Type	% of Students Making Mistakes	
		Female	Male
	c. Transformation errors	20%	6.25%
	d. Process skills errors	30%	25%
	e. Final answer writing errors (encoding errors)	10%	18.75%
4	a. Reading errors	-	-
	b. Comprehension errors	-	12.5%
	c. Transformation errors	20%	12.5%
	d. Process skills errors	100%	100%
	e. Final answer writing errors (encoding errors)	100%	100%

Researchers show and understand the stages of student errors in the table above. These error stages include comprehension errors, transformation errors, process skill errors, and final answer writing errors (encoding errors). Furthermore, it is found that female students make more mistakes than male students.

Analysis of Interview Data

Based on the findings from interviews with four students from class IV-B, it is evident that they experience various types of errors, including comprehension errors, transformation errors, process errors, and final answer writing errors (encoding errors). Subsequently, excerpts from the interviews with the four students are presented.

Question number 1 was answered by student ANP. The name listed in this report is the student's real name abbreviated as ANP. Based on the Newman method in answering question number 1, ANP is a student who often makes mistakes. From ANP's answer to question number 1, it can be observed that she followed Newman's steps in solving the problem, but incompletely. The step not taken by ANP is writing the final answer. Additionally, as shown below, ANP made mistakes in the process skill and transformation stages.

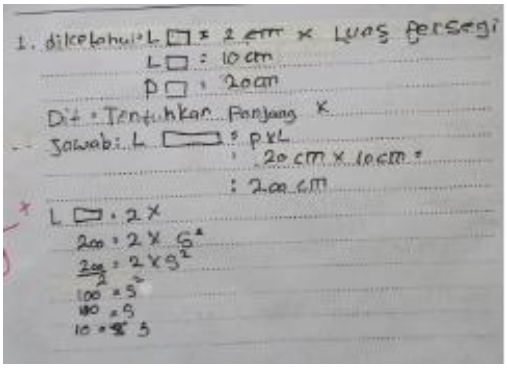

Figure 1. Excerpt of Student Response No. 1

Based on the results of the researcher's examination of the responses and interviews with ANP, it is evident that ANP has made several mistakes, including errors in processes and transformations, as well as a failure to provide a final answer or conclusion. However, during the interview, ANP could correctly identify the incorrect stages in its answer sheet and ANP could state the formula accurately even though it was found that there was an error in not fully stating the second formula when solving the problem, and there were errors in the process of solution on the answer sheet. After the interview, the researcher learned the reasons why ANP made mistakes in answering the previous questions. Transformation errors occurred as a result of ANP's negligence in writing down the formulas completely, even though ANP actually knew the formulas to use. Execution errors in processing skills emerged because ANP still wrote down numbers that should not have been written as they had already been moved, and ANP rushed, resulting in the square root symbol not being written. Additionally, ANP forgot to include a conclusion or final answer to the question.

Question 2 was attempted by student AH. AH, a male student, often provides incorrect answers when working on the second question.

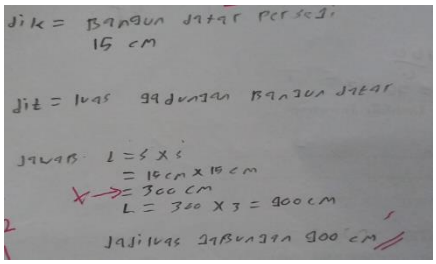

Figure 2. Excerpt of Student Response No. 2

From the examination of AH's answers and interviews conducted by the researcher, it appears that AH made several mistakes in the Newman stages, namely misunderstanding the problem, errors in solving process skills, and errors in writing the final answer. However,

during the interview, AH could correctly mention the stages that went wrong, as indicated in the explanation sheet, and AH could provide detailed explanations of what was known, even though when working on previous questions, AH did not write down this information completely. In the stage of solving process skills, AH made a mistake in multiplication calculation, and this affected the writing of the final answer. After the interview, the researcher discovered the reasons why AH made mistakes when attempting to solve the problem in the previous question. The misunderstanding of the problem occurred because AH was negligent or forgotten. In terms of process skills, this was because AH did not give careful consideration when performing and completing the multiplication calculation, resulting in inaccurate results. This affected the errors in the stage of writing the final answer for AH, which occurred due to a lack of precision in the process skills stage.

Question number 3 was answered by student AZ. The names found in this report are the real names of the students abbreviated to AZ. AZ is a female student who made mistakes in writing the answer to question number three.

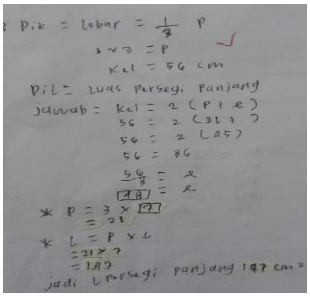

Figure 3. Excerpt of Student Response No. 3

The results of the examination of answers and interviews by the researcher with AZ indicate that AZ made transformation errors because she did not understand how to translate known information into mathematical form, thus AZ could not answer question number 3. The difference between the interview results and the answer sheet is that while working on the problem on the answer sheet, AZ seemed to be able to solve it despite some errors based on the Newman method. However, during the interview, AZ could only answer up to the part of understanding the problem. This is because AZ did not understand how to transform the problem into mathematical form. The difference arose because when AZ was working on the problem, she looked at her friend's answer, so the answer AZ wrote still contained errors.

Question number 4 was answered by student V. The names mentioned in this report are the real names of the students abbreviated to V. V is a male student who made mistakes in

providing answers while working on the fourth question.

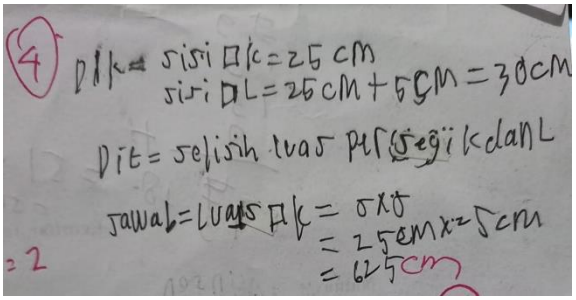

Figure 4. Excerpt of Student Response No. 4

From the examination of V's answer above to question number four, it is clear that V has accurately solved the problem based on the Newman method in understanding the problem. However, in the transformation stage of the problem, V was unable to fully transform the question.

Below is the interview with V regarding question number 4.

P : V, please look carefully at this question. Please read it out loud clearly from the question!

V : (Reading)

P : What do you know about the fourth question?

V : There are two squares, K and L.

P : What are the lengths of the sides of squares K and L?

V : Square K is 25 cm, and for square L, it means 25+5= 30 cm.

P : Correct. What is the question asking for?

V : It's asking for the difference in area between squares K and L, Miss.

P : What should V do next?

V : Calculate the area of the squares, Miss.

P : That's correct, but why did you only calculate the area of square K on your answer sheet?

V : I didn't quite understand how to complete the answer.

Referring to the results of the researcher's examination of the response data and interview with V, it is found that V made a mistake in the transformation stage. This error appeared because V did not understand how to translate the question into a mathematical formula, hence V was unable to solve question number 4.

THE LOCATION OF STUDENTS' ERRORS AND THE FACTORS THAT CAUSE ERRORS MADE BY STUDENTS

Information was gathered from a study conducted on 26 students in class IV-B at one of the primary schools in East Jakarta. It was found that students experienced errors in problem comprehension, problem transformation, process skills, and writing the final results. This aligns with what Newman stated in White (2010), suggesting that when students answer questions in word problems, they go through various stages including reading the problem, comprehending the problem, transforming the problem, processing skills, and writing conclusions (encoding). Based on Newman's viewpoint, the researcher concluded that there are five types of errors that students may encounter when solving mathematical word problems. According to this study, when students are still trying to understand the problem concept, they make errors, namely the students' lack of understanding of the information given in the problem comprehensively. This is done by students because they are in a hurry, causing them to forget to write down the known steps completely. The inability of students to apply relevant formulas to solve mathematical word problems leads to errors in problem transformation. Additionally, students' lack of skill in creating or lack of practice results in difficulty in transforming word problems into mathematical formulas due to their lack of understanding. Errors in the process skills stage are caused by students' mistakes in the problem transformation stage; thus, students are not yet able to understand the concept of solving geometric formulas, and errors in multiplication calculations are caused by students' lack of precision. Errors in writing the final answer are caused by students rushing to complete the problem and forgetting to provide a complete answer.

The researcher agrees that according to Jha and Singh, as cited in Oktaviana (2017), the cause of students' errors in problem comprehension is due to a lack of understanding of the problem, causing students to struggle to determine the information given and requested in the problem. Errors in problem transformation occur because students cannot select/distinguish mathematical operation signs to be applied to solve the problem posed in the question. Errors in process skills are caused by students' inability to solve problems and use appropriate procedures when applying mathematical operations. In the final stage, especially when writing the final answer, this occurs due to a lack of memory to write or check their final answers. According to the views expressed by Jha and Singh, it is concluded that

there are reasons why students make errors in problem comprehension, problem transformation, process skills, and writing final answers stages.

FACTORS THAT MAKE STUDENTS NOT UNDERSTAND MATHEMATICAL CONCEPTS IN SOLVING PLANE GEOMETRY WORD PROBLEMS

The findings of interviews conducted by the researcher with the class teacher of IV-B regarding factors that make students struggle to understand concepts to solve plane geometry word problems are (1) Lack of focus of students in receiving lessons; (2) students' very simple or slow comprehension; (3) students engage in other activities while the teacher explains the material, for example, engaging in conversations throughout the learning process, which makes students struggle to understand mathematical concepts when solving plane geometry word problems. This is in line with the findings of Noto et al. (2019) where students feel difficulty in learning mathematics due to the challenge of applying mathematical concepts in real-life contexts, the need for precise accuracy, the time required to understand concepts, and the difficulty in proving their answers. Another factor contributing to students' errors is the common difficulty faced by students in visualizing plane geometry shapes and their elements (Rahayu, 2021).

EFFORTS TO HANDLE STUDENTS' ERRORS IN SOLVING PLANE GEOMETRY WORD PROBLEMS

Based on the interview results conducted by the researcher with the IV-B class teacher regarding the appropriate efforts to handle students' errors when solving plane geometry word problems are: (1) Understanding the students' characteristics allows the teacher to identify where the students' misunderstandings lie and the factors of misunderstanding within the students themselves; (2) Repeating material from simple learning with simple numbers to difficult learning stages. Also, providing exercises from simple to more difficult levels; (3) In teaching mathematics, especially plane geometry, teachers and students should make an agreement that the students must focus during the learning process. If a student violates this agreement, they will be given a sanction to study outside the class; (4) Teachers must have techniques and teaching methods that can be easily understood by students; (5) Teachers must be creative by having various teaching methods to handle the different characters of students in learning. This is in line with the findings by Nuraeni & Syihabuddin (2020), the key

to success for a senior teacher who has proven to produce great generations is that they do not get tired of repeating the lessons until students can memorize the material and then move on to new material. Additionally, the lack of student motivation is one of the factors causing low student achievement (Fauzi et al., 2020).

CONCLUSION

Based on the findings and data analysis, here are the errors made by students when attempting to solve mathematical word problems involving plane geometry: (1) Error in comprehension, namely not including all known information in detail in the question; (2) Error in problem transformation, students are unable to predict the formula to be used to solve the mathematical word problem; (3) Error in process skill, students make mistakes when multiplying, resulting in incorrect answers; (4) Errors in final answer writing (encoding errors), where students forget to include the final answer on the answer sheet.

When students work on plane geometry word problems, the following factors contribute to errors: (1) Error in comprehension, where students rush to complete the problem, leading them to forget to write down the known steps completely; (2) Error in transformation, as students struggle to predict relevant formulas to solve mathematical word problems. Additionally, students' lack of skill in creating or transforming word problems into mathematical forms due to insufficient practice or experience in the process contributes to misunderstanding. (3) Error in process skill, occurring due to students' mistakes in problem transformation, resulting in a lack of understanding of the concept of solving geometric formulas, and errors in multiplication calculations due to students' lack of precision. (4) Errors in final answer writing (encoding errors), particularly caused by rushing to finish the questions and forgetting to record the final answer.

Efforts made to correct students' mistakes when solving plane geometry word problems include: (1) Understanding students' characteristics. (2) Reviewing materials and practicing problems from simple to difficult levels. (3) Establishing agreements to ensure students' focus during the learning process. (4) Teachers should have techniques and teaching methods that are easily understood by students. (5) Teachers should be creative and possess various teaching methods to handle different student characters in learning. Further research is expected to find solutions to the errors made by students when solving plane geometry word

problems or analyze students' mistakes when working on gender-based mathematics learning.

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REFERENCES

Anggraini, Y. (2021). Analisis Persiapan Guru Dalam Pembelajaran Matematika Di Sekolah Dasar. *Jurnal Basicedu*, *5*(4), 2415–2422. Https://Doi.Org/10.31004/Basicedu.V5i4.1241

Darmawan, I., Kharismawati, A., Hendriana, H., & Purwasih, R. (2018). Analisis Kesalahan Siswa SMP Berdasarkan Newman Dalam Menyelesaikan Soal Kemampuan Berpikir Kritis Matematis Pada Materi Bangun Ruang Sisi Datar. *JURING (Journal For Research In Mathematics Learning)*, *1*(1), 71. Https://Doi.Org/10.24014/Juring.V1i1.4912

Fauzi, A., Sawitri, D., & Syahrir, S. (2020). Kesulitan Guru Pada Pembelajaran Matematika Di Sekolah Dasar. *Jurnal Ilmiah Mandala Education*, *6*(1). Https://Doi.Org/10.36312/Jime.V6i1.1119

Lestari, K. E. Dan Y. (2017). *Penelitian Pendidikan Matematika*. Bandung: PT Refika Aditama.

Mulyadi, Riyadi, & Subanti, S. (2015). Analisis Kesalahan Dalam Menyelesaikan Soal Cerita Pada Materi Luas Permukaan Bangun Ruang Berdasarkan Newman'S Error Analysis (Nea) Ditinjau Dari Kemampuan Spasial. *Jurnal Elektronik Pembeljaran Matematika*, *3*(4), 370–382. Http://Jurnal.Fkip.Uns.Ac.Id

Noto, M. S., Priatna, N., & Dahlan, J. A. (2019). Mathematical Proof: The Learning Obstacles Of Pre-Service Mathematics Teachers On Transformation Geometry. *Journal On Mathematics Education*, *10*(1), 117–126. Https://Doi.Org/10.22342/Jme.10.1.5379.117-

126

Nuraeni, N., & Syihabuddin, S. A. (2020). Mengatasi Kesulitan Belajar Siswa Dengan Pendekatan Kognitif. *Jurnal BELAINDIKA (Pembelajaran Dan Inovasi Pendidikan)*, *2*(1), 19–20. Https://Doi.Org/10.52005/Belaindika.V2i1.24

Oktaviana, D. (2017). Analisis Tipe Kesalahan Berdasarkan Teori Newman Dalam Menyelesaikan Soal Cerita Pada Mata Kuliah Matematika Diskrit. *Jurnal Pendidikan Saink Dan Matematika*, *5*, 22–32. Https://Doi.Org/:

Oktaviani, Y. P., Destiniar, D., & Handayani, W. (2023). Analisis Kesulitan Belajar Matematika Pada Materi Bangun Datar Di Kelas IV SD Negeri 189 Palembang. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, *8*(2), 4746–4755. Https://Journal.Unpas.Ac.Id/Index.Php/Pendas/Article/View/9257

Rahayu, E. (2021). Problema Kesulitan Peserta Didik Sekolah Dasar Dalam Pembelajaran Geometri. *Attàlim : Jurnal Pendidikan*.

Retna, M., Mubarokah, L., & Suhartatik. (2013). *Proses Berpikir Siswa Dalam Menyelesaikan Soal Cerita Ditinjau Berdasarkan Kemampuan Matematika*. *1*(2), 71–82.

S. Sirate, F. (2012). Implementasi Etnomatematika Dalam Pembelajaran Matematika Pada Jenjang Pendidikan Sekolah Dasar. *Lentera Pendidikan : Jurnal Ilmu Tarbiyah Dan Keguruan*, *15*(1), 41–54. Https://Doi.Org/10.24252/Lp.2012v15n1a4

Singh, P., Rahman, A. A., & Hoon, T. S. (2010). The Newman Procedure For Analyzing Primary Four Pupils Errors On Written Mathematical Tasks: A Malaysian Perspective. *Procedia - Social And Behavioral Sciences*, *8*(5), 264–271. Https://Doi.Org/10.1016/J.Sbspro.2010.12.036

Sugiono. (2014). *Metode Penelitian Kombinasi*. Bandung: Alfabeta.

Sugiyono. (2017). *Metode Penelitian Kuantitatif, Kualitatif, Dan R&D*. Bandung : Alfabeta.

Utari, D. R., Wardana, M. Y. S., & Damayani, A. T. (2019). Analisis Kesulitan Belajar Matematika Dalam Menyelesaikan Soal Cerita. *Jurnal Ilmiah Sekolah Dasar*, *3*(4), 545. Https://Doi.Org/10.23887/Jisd.V3i4.22311

Vaiyatvutjamai, P., & Clements, M. A. (2004). *Analysing Errors Made By Middle-School Students On Six Linear Inequations Tasks*. University Brunei Darussalam.

White, A. L. (2010). Numeracy, Literacy, And Newman's Error Analysis. *Journal Of Science And Mathematics Education In Southeast Asia 2010. Vol. 33 No. 2*.

WT, W., Meiliasari, & Dhianti, L. (2023). Analisis Kesalahan Siswa Dalam Menyelesaikan Soal Cerita Pada Materi Aritmatika Sosial Berdasarkan Tahapan Newman's Error Analysis (NEA) Kelas VII Smp Negeri 187 Jakarta. *Jurnal Riset Pembelajaran Matematika Sekolah*, *7*(1), 66–79. Https://Doi.Org/10.21009/Jrpms.071.08