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Description of Students' Errors in Solving Story Problems on One Variable Linear Equations (PLSV) in Grade VII

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ABSTRACT

This study was motivated by observations and interviews indicating that most students experienced difficulties in solving word problems related to Single Variable Linear Equations (SVLE), particularly in transforming verbal statements into mathematical models. These difficulties were identified among seventh-grade students at a junior high school, where students generally understood the problems but still made errors in determining variables, constructing mathematical models, and performing algebraic operations correctly. Therefore, this study aimed to describe the types of errors made by students in solving SVLE word problems based on Newman's error analysis procedure. This study employed a descriptive qualitative approach. The research subjects consisted of five seventh-grade students selected through purposive sampling based on the representation of error patterns identified in the diagnostic test results. The research instruments included the researcher as the primary instrument, supported by essay test questions and interview guidelines. Data analysis was conducted using the Miles and Huberman model, which involved data reduction, data presentation, and conclusion drawing. Data validity was ensured through technical triangulation by comparing students' written answers with interview results. The findings revealed that most students experienced difficulties in transforming information from word problems into mathematical models of Single Variable Linear Equations. Transformation errors were the most dominant type of error, indicating that students had not yet mastered the process of determining appropriate equations despite understanding the known and required information. In contrast, process skill errors were relatively low, suggesting that students were generally capable of performing mathematical operations correctly when the equation model was properly constructed. These findings indicate that students' primary difficulty lies in translating contextual problems into mathematical representations, highlighting the need for instruction that emphasizes conceptual understanding, problem analysis, and mathematical modeling skills.

Keywords: Error Description 1; Problem Story 2; Algebra 3; Newman Procedure 3;

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1. INTRODUCTION

Mathematics plays a crucial role in developing students' logical, critical, and systematic thinking skills. Besides being a calculation tool, mathematics also helps students solve various everyday life problems through a directed reasoning process (Widiani, 2026). Mathematics also trains students to think coherently and solve problems systematically in various life contexts (Ishak et al., 2025). According to Sumarni et al. (2023), mathematics is the science of patterns and relationships, logical and systematic thinking, and a tool for solving life's problems. Meanwhile,

Sumarmo states that mathematics is an abstract and deductive reasoning activity that emphasizes regularity, patterns, and structure to find solutions to problems.

The importance of learning mathematics also aligns with the national education goals stated in Law Number 20 of 2003 concerning the National Education System, namely to develop students' potential to become knowledgeable, creative, independent, and responsible individuals (Yanti, 2021). Therefore, mathematics is a crucial subject taught at every level of education, including junior high school (SMP). One crucial topic in SMP mathematics is Linear Equations in One Variable (LSV), as this material forms the basis for understanding algebraic concepts and solving other mathematical problems. According to the Ministry of National Education, algebra is a branch of mathematics that discusses the relationship between variables and mathematical operations in symbolic form.

During the learning process, students often experience difficulties when solving word problems in the LVLSV material. These difficulties arise because students are not only required to perform calculations but also to understand the information in the problem, convert it into mathematical form, and determine the correct solution steps. As a result, many students still make errors when solving mathematics word problems. These errors need to be analyzed so that teachers can identify the source of students' difficulties and determine appropriate learning strategies.

In addition, research by Novita & Rusdi (2021) shows that many students experience difficulty in determining variables and transforming verbal sentences into algebraic form, resulting in frequent conceptual and procedural errors. These difficulties indicate that students' success in solving mathematical word problems depends not only on their arithmetic skills but also on their ability to understand language, recognize important information, and choose appropriate solution strategies.

Accordingly, word problems are a common problem format used to train students' ability to translate contextual problems into mathematical form logically and systematically (Septriansyah et al., 2023). Therefore, conceptual understanding and the ability to read and interpret mathematical information are crucial factors in determining the accuracy of the process and results of solving mathematical problems. Moreover, word problems play a crucial role in instilling contextual and applicable mathematical concepts. In the context of algebra learning, word problems serve as a means to develop mathematical modeling and critical thinking skills. Students are trained to identify variables, determine relationships between quantities, and write algebraic expressions for situations presented in narratives. According to Agustini & Pujiastuti (2017), through word problems, students not only memorize formulas but also learn to understand the meaning and application of mathematical concepts in real life.

Student errors in solving word problems are a persistent challenge in mathematics learning. Word problems require reading skills, understanding context, and transforming verbal information into logical mathematical forms. According to Purnami and Mulyono, students often misunderstand the meaning of key words in the problem, omit important information, or misinterpret the question, resulting in incorrect answers (Layn & Kahar, 2017). This is exacerbated by students' low reading comprehension skills, which makes them unable to distinguish between relevant and irrelevant information in word problems.

Based on an interview conducted by the author with a mathematics teacher at SMP Negeri 2 Ampek Angkek on August 18, 2025, it was found that most students were quite capable of understanding the meaning of the story problems given, particularly in reading and recognizing the instructions in the problems. However, the teacher also reported that several students still

experienced difficulties in the transformation stage, which involves converting verbal information from the story problem into a mathematical model. This transformation difficulty was the most prevalent, while for the solution stage, the teacher observed that only a few students appeared to have not yet mastered basic operational skills such as multiplication. This caused them to experience obstacles in solving the problems, even though they understood the content. The teacher explained that the difficulty of transformation was a major cause of errors, while weak mastery of basic operations was a less significant problem in solving story problems based on one-variable algebraic forms.

The low mathematical ability of Indonesian students in solving story problems remains a challenge in learning today. A study conducted by Rahmania & Rahmawati, (2016) examined the ability of seventh-grade students to solve word problems on linear equations with one variable, emphasizing the importance of students' ability to understand and translate problems into mathematical models. However, the study did not specifically classify the types of student errors systematically as a basis for identifying student difficulties in each stage of problem solving. Furthermore, a study conducted by Ndek et al., (2022) also discussed students' abilities in solving algebraic mathematical word problems, particularly in the aspects of understanding information and constructing mathematical models. However, the study did not provide an in-depth description of the detailed classification of student errors and did not store these errors in the students' thinking process in solving word problems.

The description in this study uses Newman's procedure to systematically identify the location of student errors. According to Irianti et al. (2024), student errors in solving mathematics problems can be explained through five main stages: reading, understanding, transformation, process skills, and coding. This analysis is used to identify the location of student errors more specifically so that teachers can understand the difficulties students experience in solving mathematics problems. Newman stated that student failure in solving problems is not always caused by a lack of numeracy but can also occur because students are unable to understand the problem, transform information into a mathematical model, or write the final answer correctly. Similarly, according to Suratih & Pujiastuti (2020), Newman Error Analysis is an effective diagnostic procedure for tracing students' thought processes when solving mathematics problems. Through this analysis, teachers can identify in detail the most dominant types of errors made by students, thus providing a basis for determining more appropriate learning strategies.

Several relevant studies also demonstrate that Newman Error Analysis is effective for analyzing student errors. Research by Hajizah & Salsabila (2024) shows that most student errors occur at the comprehension and transformation stages because students lack a grasp of important information in math story problems. Furthermore, research by Lanya et al. (2023) found that Newman Error Analysis helps teachers identify students' procedural errors at the process skills and coding stages, enabling them to provide more tailored learning interventions. Therefore, Newman Error Analysis can be used as an effective analytical tool to systematically and in-depth identify the types and causes of student errors in solving math problems.

The use of Newman Error Analysis in this study is because this method is able to identify in detail the stages of errors made by students in solving mathematical word problems. Furthermore, Newman Analysis is very relevant for use in the material of Linear Equations of One Variable (PLSV), especially in word problems, because this material requires the ability to understand language, translate into mathematical models, and accuracy in calculations. Student errors occur not only in the calculation aspect, but also in understanding the context of the problem, so the Newman approach is more comprehensive than conventional analysis.

Based on these two studies, a research gap exists: there has been no comprehensive study describing the types of student errors in solving math story problems in algebra, particularly among seventh-grade junior high school students. Therefore, this study aims to describe student errors in solving algebra story problems in seventh-grade junior high school students, thereby providing a clearer picture of the types and causes of student errors as a basis for improving mathematics learning. Based on the description above, the author is interested in conducting research with the title "Description of Student Errors in Solving Story Problems on Algebra Material in Class VII of Middle School".

2. METHODS

This research, which describes students' errors in solving word problems, is a descriptive study using a qualitative approach. It aims to describe students' errors in solving word problems on the topic of Single-Variable Linear Equations (PLSV) based on the Newman Error Analysis procedure. The research was conducted at SMP Negeri 2 Ampek Angkek in the odd semester of the 2024/2025 academic year. The subjects were 31 students in grade VII-1. Subjects were selected using a purposive sampling technique based on diagnostic test results, resulting in five students representing a variety of error patterns: dominant errors, multiple errors, and errors with the lowest frequency. Data sources consisted of primary data in the form of interviews with the research subjects and secondary data in the form of student test result documents. The research instruments included the researcher as the primary instrument and supporting instruments in the form of essay tests and interview guidelines. Data collection techniques included written tests and in-depth interviews. Tests were used to identify the types of student errors, while interviews were used to clarify and understand the causes of the errors.

Data analysis refers to the Miles and Huberman model, which includes data reduction, data presentation, and conclusion drawing. The validity of the data was tested through technical triangulation, namely by comparing the results of tests and interviews. The description of student errors in the study used the Newman Error Analysis procedure which includes five stages, namely: (1) reading errors, (2) comprehension errors, (3) transformation errors, (4) process skills errors, and (5) errors in writing the final answer (encoding errors). The student error analysis test question grid based on the newman procedure, can be seen in the table below:

Table 1. Student Error Analysis Test Question Grid Based on the Newman Procedure

Question	Question Indicator	Types of Newman Errors
1. Andi's height is 155 cm. Candra's height is 7 cm less than Andi's. If t is Candra's height in cm, write an equation to find t and calculate Candra's height!	Students can clearly interpret words, terms, and symbols when reading a problem as a whole.	Reading
	Students can explain the meaning of the relationship between information and the question's question.	Comprehension
	Students can write a mathematical model to find Candra's height.	Transformation
	Students can solve the model to find the value of a variable.	Process Skill
	Students can write the final answer for Candra's height using the correct units.	Encoding
2. To prepare for an exam, Budi bought 3 notebooks and 1 pen at the	Students can clearly interpret words, terms, and symbols when reading a problem as a whole.	Reading

school cooperative. He paid a total of Rp 11,000. Budi remembers that one notebook is Rp 2,000 more expensive than one pen. How much does one pen cost Budi?	Students can explain the meaning of the relationship between information and the question's question.	Comprehension
	Students can write a mathematical model for the relationship between the total price of goods.	Transformation
	Students can solve for the value of x and determine the correct result.	Process Skill
	Students can write the final answer for the price of one pen using the correct units.	Encoding
3. Fajar and Dina are counting their marbles. After counting, Fajar has 12 marbles. Fajar's marbles are 5 fewer than Dina's. How many marbles does Dina have in total?	Students can clearly interpret words, terms, and symbols when reading a problem as a whole.	Reading
	Students can explain the meaning of the relationship between information and the question being asked.	Compreension
	Students can write a mathematical model for the relationship between Fajar and Dina's marbles.	Transformation
	Students can solve for the value of x and determine the correct result.	Process Skill
	Students can write the final answer for Dina's marbles with the correct units.	Encoding
4. Dita and Rani are two best friends who often celebrate birthdays together. This year, they are curious to know their age comparison. Dita says she is 5 years older than Rani. If the sum of their ages is 23, how old are Dita and Rani, respectively?	Students can clearly interpret words, terms, and symbols when reading a problem as a whole.	*Reading*
	Students can explain the meaning of the relationship between information and the question's question.	*Comprehension*
	Students can write a mathematical model for the relationship between Dita and Rani's ages.	*Transformation*
	Students can use algebraic process skills to find the value of x and Dita's age.	*Process Skill*
	Students can write the final answer for Dita and Rani's ages using the correct units.	*Encoding*

3. RESULTS AND DISCUSSION

3.1 Subject 1 (S-1)

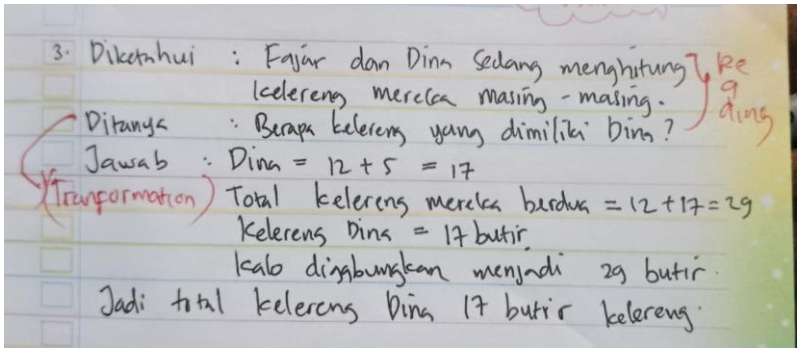

Figure 1. Subject 1's Answer Results (S-1)

Based on Figure 1, the subject made a reading error because he didn't write down the "known" information completely. The subject didn't make a comprehension error. However,

he made a transformation error because he didn't create a mathematical model and immediately performed the arithmetic operation (12 + 5). The subject didn't make any errors in process skills or writing the final answer.

The following is the result of an interview with S-1:

P : Could you explain how you solved this problem?
S1 : Dina = 12 + 5 = 17
P : How did you create the mathematical model?
S1 : Just add them, sir.
P : What is the question asking?
S1 : The number of marbles Dina has.

The main error lies in the transformation, namely the inability to convert the problem into a mathematical model. The student actually understands the problem but immediately uses arithmetic operations without modeling.

3.2 Subject 2 (S-2)

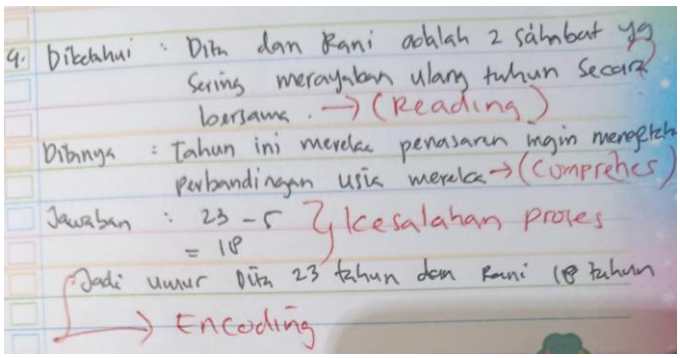

Figure 2. Subject 2's Answer Results (S-2)

Based on Figure 2, Subject 2 (S-2) made errors at almost every stage of the problem-solving process. In the reading stage, the student failed to write down all the important information known from the problem, resulting in the inability to identify the data needed to solve the problem. Furthermore, in the comprehension stage, the student also lacked a clear understanding of the question's actual question. This was evident in the answer, which did not indicate a comparison of ages but instead directly performed an inappropriate arithmetic operation.

In the transformation stage, the student was unable to transform the information in the problem into a proper mathematical model. The student failed to create an equation or calculation steps that illustrated the relationship between Dita and Rani's ages. Consequently, in the process skills stage, the student used an incorrect procedure by subtracting (23 - 5), resulting in a result of 18 without a valid basis for the solution. This error in the calculation process also led to an error in the encoding stage, as the student concluded that Dita's age was 23 and Rani's was 18 without supporting evidence appropriate to the context of the problem. Thus, the initial misunderstanding impacted the entire problem-solving process, leading to the final conclusion.

The following is an interview with S-2:

P : How did you solve this problem?
S2 : 23 – 5 = 18
P : How did you create the mathematical model?
S2 : Not enough...

P : What is the question asking?
S2 : Dita and Rani's ages.
P : Are you sure about your answer?
S2 : Yes, sir.

The subject made errors at almost all of Newman's stages, especially at the transformation stage, which resulted in errors in the process and the final answer. However, the interview showed that the subject actually understood the problem verbally.

3.3 Subject 3 (S-3)

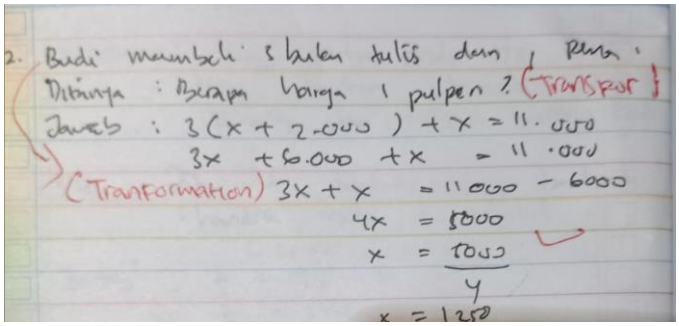

Figure 3. Results of Subject 3's Answers (S-3)

Based on Figure 3, the subject made no reading or comprehension errors. However, the subject made a transformation error, namely not writing a complete variable example. The subject did not make any process skill errors. On the answer sheet, the subject also made no errors in writing the final answer.

The following is the result of an interview with S-3:

Q : How did you convert the problem into a mathematical model?
S : 3(x + 2000) + x = 11,000
Q : Can you explain where the model came from?
S3 : (does not explain the example)
Q : What is the final result?
S3 : x = 2025

The main error lies in the transformation, namely the inability to explain the modeling process. Furthermore, there were inconsistencies in the encoding stage during the interview, where the answers given differed from the results on the answer sheet.

3.4 Subject 4 (S-4)

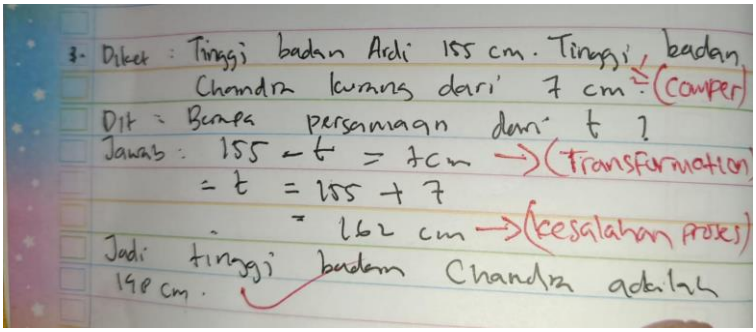

Figure 4. Subject 4's Answer Results (S-4)

Based on Figure 4, Subject 4 (S-4) did not experience errors in the reading stage because the student was able to read and write down the known information from the problem quite

accurately. Information regarding height and the relationships between data points had been recorded, indicating that the student recognized important data in the problem.

However, in the comprehension stage, the student did not fully understand the question. This was evident because the student only wrote down part of what was asked, so the goal of solving the problem was not fully stated. Furthermore, in the transformation stage, the student made an error in constructing the mathematical model. The relationship between the known and asked data was not translated into the correct equation, resulting in inaccurate solution steps.

Errors also occurred in the process skills stage. The student used an incorrect algebraic procedure, as seen in step (t = 7 + 155), which did not align with the mathematical model that should be used. However, in the encoding stage, the student did not experience errors because the final result obtained was correct, namely Chika's height is 148 cm after corrections to the calculation process. This indicates that the student was still able to write the final answer correctly despite the errors in the previous solution steps.

Interview Excerpt

Q : What is the question asking?
S4 : Equation to find t
Q : How do you create a mathematical model?
S4 : Suppose... (not continued)
Q : Explain the calculation steps?
S4 : 155 – t = 7, so t = 7 + 155 = 162
Q : What is the final answer?
S4 : Candra's height is 148 cm
Q : Are you sure?
S4 : Not yet, sir.

The subject experienced errors in understanding, transformation, and processing, but was able to improve the final result. The interview revealed some hesitation even though the answer was correct.

3.5 Subject 5 (S-5)

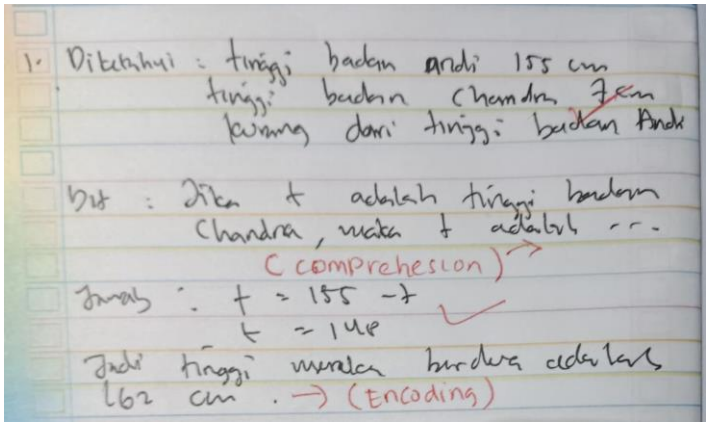

Figure 5. Subject 5's Answer Results (S-5)

Based on Figure 5, Subject 5 (S-5) did not make any errors in the reading stage because the student was able to read the information in the problem well. This is evident in the student's ability to write down the known data, namely, Andi's height is 155 cm and Candra's height is 7 cm shorter than Andi's.

However, in the comprehension stage, the student made an error because he was unable to clearly distinguish between the known and the questioned. The student immediately wrote down the information and questions without proper grouping, resulting in an incomplete understanding of the question's intent. Furthermore, in the transformation stage, the student also made an error because he did not write down the mathematical model or equation used to solve the problem. The student immediately performed arithmetic operations without showing the mathematical relationship between the information.

In the process skills stage, the student did not make any errors because the calculation process was correct: (155 - 7 = 148). However, in the encoding stage, the student made an error in writing the final conclusion. The student wrote, "Their height is both 162 cm," when the question was about Candra's height, so the conclusion presented did not align with the context of the problem. This error shows that the student was not careful in providing the final answer even though the calculation results were correct.

Q : What important information did you find?
S5 : Find Candra's height and t
Q : How do you create a mathematical model?
S5 : Subtract, sir
Q : Explain the calculation?
S5 : t = 155 – 7 = 148
Q : What is the final answer?
S5 : Candra's height is 144 cm
Q : Are you sure?
S5 : Sure, sir

The subject made errors in comprehension, transformation, and encoding. Although the calculation was correct, the subject failed to conclude the answer correctly. Based on the description of students' errors in solving story problems on One Variable Linear Equations (PLSV) using the Newman procedure, it was found that students' errors occurred in almost all Newman stages, namely reading, comprehension, transformation, process skills, and encoding. Newman analysis is used to identify in detail the location of students' errors in solving mathematical story problems so that teachers can find out the factors causing students' learning difficulties in more depth. According to research conducted by Lubis et al., (2025), the Newman procedure is effective for analyzing students' errors because it is able to show the stages of students' thinking when solving mathematical problems.

In the reading stage, students generally did not experience reading errors. Although some students did not write down complete information on the answer sheet, interview results showed that all subjects were able to read the questions well. This suggests that the errors that emerged were more procedural in nature than actual reading errors. This finding aligns with research by Fitry et al. (2022), which stated that reading errors in math story problems are relatively low because students are generally able to recognize simple mathematical symbols and sentences. Therefore, the main obstacle for students is not reading ability, but rather understanding and transforming the problem.

In the comprehension stage, conceptual and procedural errors were found. Students had difficulty understanding the overall meaning of the problem and were unable to accurately determine the known and required information. According to research by Widyaningrum (2017), comprehension errors occur because students are unable to interpret the language in story problems into mathematical meaning. Furthermore, students tend to rush through problems

without reading thoroughly, thus overlooking important information in the problem. This finding is further supported by research by Nisa & Wandani (2023), which states that poor problem-solving skills make it difficult for students to determine appropriate problem-solving strategies. The most dominant errors were found in the transformation stage. Most students were unable to transform story problems into mathematical models in the form of linear equations with one variable and directly used simple arithmetic operations. This indicates that students still experience difficulties in mathematical representation, especially converting verbal language into symbolic form. According to research by Musyarofah et al., (2025), transformation errors are the most common errors in solving algebraic story problems because students do not yet understand the concept of variables and mathematical modeling in depth. Another study by Fatih et al., (2025) also showed that students tend to have difficulty determining the variables and relationships between information in story problems, resulting in inaccurate mathematical models. This condition indicates that mathematics learning is still too procedure-oriented and does not train students' mathematical representation skills.

At the process skills stage, relatively few errors were found. Most students were able to perform arithmetic operations correctly if the mathematical model was already available. Errors only occurred in a few students who were less thorough in performing algebraic manipulations or using solution procedures. This finding aligns with research by Pujawan & Astawa (2026), who stated that process errors usually arise as a result of errors at the transformation stage. In other words, students are actually capable of performing calculations but encounter difficulties in determining the mathematical form that must be solved.

At the encoding stage, some students were unable to write final answers according to the context of the problem. These errors were evident when students wrote conclusions that did not match the question or were unable to interpret the calculation results into the final answer. According to research by Tarigan & Tasyah (2024), encoding errors occurred because students were less accustomed to communicating mathematical results in writing and focused more on the calculation process than on interpreting the answers. Furthermore, poor mathematical communication skills were also a contributing factor to students' lack of thoroughness in writing final conclusions.

Overall, the research results showed that transformation errors were the most prevalent error, while process skills errors were the least common. These findings indicate that students' primary difficulty lies in their ability to model word problems in mathematical terms, rather than in their ability to read or count. Therefore, teachers need to provide instruction that emphasizes conceptual understanding, mathematical representation skills, and gradual practice of contextual word problems. Learning approaches such as Problem-Based Learning (PBL), Realistic Mathematics Education (RME), and scaffolding can be used to help students understand the relationship between real-world problems and mathematical models, thus minimizing errors in solving word problems.

4. CONCLUSION

Based on the research results, it can be concluded that the errors of seventh-grade students of SMPN 2 Ampek Angkek in solving story problems on One Variable Linear Equations (PLSV) using the Newman procedure were dominated by errors at the transformation stage, namely the inability to convert the story problem into a mathematical model. At the reading stage, no actual errors were found because all students were able to read and understand the problem orally. At the understanding stage, there were conceptual and procedural errors, although some students

actually understood the meaning of the problem. Errors at the process skills stage were relatively few and generally occurred due to errors in the previous stage. Meanwhile, at the stage of writing the final answer, errors were still found in drawing conclusions that were appropriate to the context of the problem. Thus, the main difficulty for students lies in the ability to model story problems into mathematical form, not in the ability to read or perform calculations.

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