Identifying Types of Student Errors in Solving Algebraic Operation Story Problems using the Newman Procedure

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Abstract

This study aims to analyze the types of errors made by students in solving algebraic operation problems using the Newman procedure. The study uses a phenomenological qualitative approach with two seventh-grade students from MTsN Kota Batu in the 2025/2026 academic year as subjects. Data collection techniques were carried out through written tests and interviews. The results showed that neither subject S1 nor S2 made mistakes in the stages of reading and understanding the questions. Subject S1 began to show errors in the stage of converting the information in the questions into mathematical models, then made mistakes in the stage of formulating the steps to solve the problems, and again made mistakes in determining the final answers. Meanwhile, subject S2 made errors in the calculation process, which affected the accuracy of the final answer obtained. Overall, the most common type of error was in the ability to process and write down answers, which was largely influenced by a lack of precision in performing algebraic operations.

Keywords

Algebra, Mathematics Problems, Newman's Error.

Introduction

Mathematics plays an important role in shaping students' logical and systematic thinking skills (Saputra, 2024). In the learning process, mathematics emphasizes not only numeracy skills but also a deep understanding of concepts and their application in solving everyday problems. However, in reality, mathematics learning at the junior high school level still faces various problems, especially in students' ability to solve word problems. Students often find it difficult to transform information from a narrative form into an appropriate mathematical model (Andini & Kadarisma, 2025). This is due to students' low ability to understand the context of the problem, as well as a lack of practice in connecting contextual problems with relevant mathematical concepts (Rofi'ah et al, 2019). In addition, learning that emphasizes memorization of formulas without a deep conceptual understanding can cause students to have difficulty in developing logical steps to solve problems (Kharismayanda et al, 2025).

These findings indicate that the difficulties experienced by students are not merely technical errors, but reflect deeper cognitive challenges in understanding mathematical language, interpreting contextual situations, and constructing meaningful symbolic representations. Previous studies have consistently highlighted students' weaknesses in modeling and reasoning processes; however, many of these studies describe error patterns without thoroughly positioning the errors within a systematic analytical framework that traces the sequential thinking process of students. Therefore, a more structured diagnostic approach is needed to identify precisely where breakdowns occur in students' problem-solving stages.

Among the various mathematics topics taught in junior high school, algebraic operations are one of the most challenging topics because they require a combination of conceptual and procedural skills (Afrilia et al., 2022). Students must not only understand the meaning of symbols and variables, but also be able to operate algebraic forms correctly according to the applicable rules. Several studies show that many students make mistakes at the stages of reading questions, understanding information, converting sentences into symbolic forms, and performing calculations (Manurung & Asmin, 2013). Haniah & Senjayawati (2023) emphasizes that some students still rely on memorizing the steps to solve problems without truly understanding the underlying algebraic concepts, which can lead to errors.

Although these studies have identified various types of errors, most of them only present the percentage or number of mistakes made by students without clearly explaining how an error at one stage can lead to errors at the next stage of the solution process. As a result, it is still unclear how students' mistakes develop step by step from reading the problem to writing the final answer. This shows that there is still a need for a more systematic analysis that can classify errors based on each stage of students' thinking processes in solving problems.

According to Karouw et al (2023), the most common mistakes students make in solving algebraic story problems are process skill errors (38.77%), followed by encoding errors (36.73%), transformation errors (22.44%), comprehension errors (12.24%), and reading errors (2.04%). The results of this study indicate that most students are not yet able to apply systematic solution steps and still have difficulty formulating and writing down the final answer correctly. To understand students' errors in depth, an analysis is needed that can identify the location and type of errors made

by students at each stage of the mathematical thinking process. Error analysis according to Newman's procedure is one of the approaches widely used in mathematics education research. Categorizes student errors into five types, namely reading errors, comprehension errors, transformation errors, process skill errors, and answer writing errors. Using this framework, teachers can identify specifically which stage is the source of student errors (Cahyaningtyas et al., 2019).

Although Newman's procedure has been widely used, many previous studies only focus on identifying and grouping the types of errors made by students. They often do not explain clearly how these errors appear in specific algebra topics at the junior high school level. In addition, there is still limited explanation about how the results of the error analysis can be used directly by teachers to improve learning, especially in teaching algebraic operations in word problems.

In addition, various studies also show that student errors are often not only caused by weak conceptual mastery, but also by other factors such as learning habits, lack of practice, low motivation, and learning strategies that do not actively involve students. According to Oroh et al (2022), limited basic mathematical concepts are a major factor in students' errors when solving word problems. Therefore, teachers need to systematically analyze students' errors to identify where they are going wrong and provide targeted learning interventions.

In addition to these factors, students also experience difficulties when faced with word problems that require the ability to connect everyday language with mathematical symbols. This process requires a good understanding of contextual information and the ability to reason logically to form a correct mathematical model. When students fail to understand the meaning of the sentences in the problem, all subsequent steps in the solution tend to be incorrect. This is in line with Delastri & Lolang (2023.) opinion, which states that students' initial errors in solving algebraic operation problems generally lie in their understanding of basic concepts and the process of transforming verbal language into symbolic form. Thus, analytical thinking skills, understanding of mathematical language, and accuracy are key factors in successfully solving algebraic story problems.

Based on this explanation, it is important to conduct research on students' errors in solving word problems on algebraic operations. Different from previous studies that mainly report the number or percentage of errors, this study uses Newman's

procedure to analyze students' mistakes step by step, starting from reading the problem to writing the final answer. Through this step-by-step analysis, this study aims to show more clearly at which stage students experience difficulties when solving algebraic word problems at the junior high school level.

This research is entitled "Analysis of Students' Errors in Solving Story Problems on Algebraic Operations using the Newman Procedure". The purpose of this study is to identify the types of errors made by students when solving algebraic operation problems based on each stage in Newman's procedure. The results of this study are expected to help mathematics teachers understand students' difficulties more clearly and use this information to design learning activities that focus on conceptual understanding and reduce errors in solving algebraic problems.

Method

This study used a qualitative approach with a descriptive qualitative design, which aimed to describe in depth the forms of errors made by students in solving story problems on algebraic operations (Moleong, 2016). A descriptive qualitative design was considered appropriate because this study focused on systematically identifying and classifying students' errors based on the Newman Error Analysis (NEA) framework, rather than exploring lived experiences in a phenomenological sense. Through this approach, the researcher sought to analyze how students' thinking processes led to specific types of errors at each structured stage of problem solving.

The research was conducted at MTsN Kota Batu, East Java, in the odd semester of the 2025/2026 academic year. The research subjects were selected using purposive sampling, based on certain considerations relevant to the research objectives. The subjects consisted of two seventh-grade students who had studied algebraic operations and showed different characteristics in how they solved word problems. The selection criteria included: (1) having completed instruction on algebraic operations, (2) being able to communicate their reasoning verbally during interviews, and (3) representing different patterns of written responses based on preliminary analysis. The selection of subjects was intended to obtain rich and in-depth data regarding variations of errors.

Data analysis was conducted using the Newman Error Analysis framework, which categorizes student errors into reading errors, comprehension errors, transformation

errors, process skills errors, and encoding errors. Students' written responses were examined carefully and classified according to predefined operational indicators derived from the Newman framework. Interview transcripts were then analyzed to confirm the classification of errors and to understand the reasoning underlying each identified error. When discrepancies appeared between written answers and verbal explanations, cross-analysis was conducted to ensure accurate categorization. The overall analytical process followed the stages of data reduction, data presentation, and conclusion drawing as described by Creswell (2018). Data reduction involved selecting and grouping relevant information related to error types, while irrelevant data were excluded to maintain analytical focus. The data were then presented descriptively, supported by excerpts from interview transcripts to strengthen interpretation. Finally, conclusions were drawn and verified by examining patterns of errors and ensuring consistency between written and interview data through triangulation.

To ensure trustworthiness, this study employed methodological triangulation by combining written test results and interview data from the same participants (Creswell, 2018). This process was intended to enhance credibility by verifying whether students' written errors were consistent with their verbal reasoning. Ethical considerations were addressed prior to data collection. Formal permission to conduct the research was obtained from the school. Participants and their parents were informed about the purpose of the study, research procedures, and their right to withdraw at any time without consequences. Informed consent was obtained before participation, and students' identities were protected through the use of pseudonyms in reporting the findings. All collected data were used solely for research purposes and stored securely to maintain confidentiality.

Result and Disscussion

This study aims to analyze students' errors in solving story problems on algebraic operations using the Newman procedure. The research subjects consisted of two seventh-grade students at MTsN Kota Batu in the 2025/2026 academic year, namely S1 and S2, who were selected from 32 students in the class. The research data were obtained through a written test consisting of two story problems and in-depth interviews to identify the types of errors made by students. These types of errors were analyzed using Newman's five stages of error, namely: (1) reading errors, (2) comprehension errors, (3) transformation errors, (4) process skill errors, and (5)

encoding errors. The description of the analysis results in the following section is organized according to Newman's stages. Each type of error is presented along with examples of students' work and interview excerpts to reinforce the identification of errors that arise.

1. Reading Errors

   a. S1's reading error in question number 1.

      Excerpt from interview with S1:

      P : “Are there any words or symbols that you don't understand?”
      S1 : “No, I can still read it.”
      P : “What does the symbol x in the question mean?”
      S1 : “x is the contents of the orange box.”

      The interview excerpt shows that subject S1 was able to read and recognize the symbols used in question number 1 well. He was able to repeat the written information without showing any signs of confusion or misinterpretation of the mathematical symbols in the question. This shows that S1 did not make any mistakes in the reading stage, both in terms of the text and the algebraic symbols used.

   b. S1's reading error in question number 2

      Excerpt from the interview with S1:

      P : “Are there any words or symbols that you don't understand?”
      S1 : “No.”
      P : “What statement did you read in the question?”
      S1 : “The question says the length is $3x + 4$ and the width is $2x - 5$.”

      The interview excerpt shows that subject S1 was able to read and recognize the mathematical symbols that appeared in question number 1 well. When asked if there were any words or symbols that he did not understand, S1 replied that he could read all the terms clearly. He was even able to repeat important information such as “length $3x + 4$” and “width $2x - 5$” without showing any hesitation. This shows that S1 did not make any mistakes in the reading stage, both in terms of the text and the algebraic symbols used.

   c. S2's reading error in question number 1.

      Excerpt from the S2 interview:

      P : “Are there any words or symbols that you don't understand?”
      S2 : “No, there aren't.”
      P : “What does the symbol x in the question mean?”

S2 : "x is a variable, it means the contents of the orange box, which are unknown."

The interview excerpt shows that subject S2 can read and understand the symbols that appear in question number 1. He states that there are no confusing words or symbols, and is even able to explain that x is a variable that represents the unknown number of oranges in the box. This shows that S2 did not make any mistakes in the reading stage.

d. S2's reading error in question number 2

Excerpt from S2's interview:

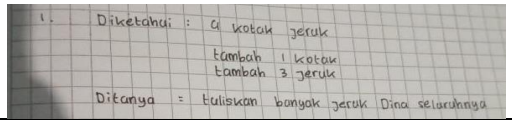
P : "Are there any words or symbols that you don't understand?"
S2 : "No, ma'am."
P : "What statement did you read in the question?"
S2 : "In the question, there is a length of $3x + 4$ and a width of $2x - 5$, ma'am."

The interview excerpt shows that subject S2 was able to read and recognize the information and symbols in question number 2 well. He stated that there were no confusing words or symbols and was able to repeat the statements in the question, such as "length $3x + 4$ " and "width $2x - 5$." This shows that SP-01 did not make any mistakes in the reading stage.

Overall, both S1 and S2 were able to read all the information contained in the questions correctly. Both were able to recognize important terms, understand basic algebraic symbols, and interpret the information presented without showing any errors in identification. Thus, it can be concluded that at the reading stage, both subjects did not experience any reading errors and had adequate basic mathematical literacy skills to proceed to the stage of understanding and solving the questions.

2. Errors in Comprehension

a. S1's comprehension error in question number 1



Translate
1. Given: 4 boxes of oranges
plus 1 box
plus 3 oranges
Question: Write down the total number of oranges Dina has.

Figure 1. Results of S1's work on question number 1

Excerpt from the interview with S1:

P : "After reading the question, what information do you know?"

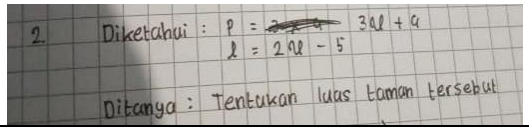
S1 : "What I know is that there are 4 boxes, then 1 more box is added, then 3 more oranges are added."

P : "What is being asked in the question?"

S1 : "The algebraic form, sis."

The interview excerpt shows that subject S1 was able to mention important information from the question and understand what was being asked. He was able to identify data such as the number of boxes and additional oranges, and knew that what was being asked was the algebraic form. This shows that S1 did not make a mistake at the comprehension stage.

b. S1's comprehension error in question number 2



Translate
2. Given: $p = 3x + 4$
$l = 2x - 5$
Question: determine the area of the garden.

Figure 2. S1's work for question number 2

Excerpt from the interview with S1:

P : "After reading the question, what information do you know?"

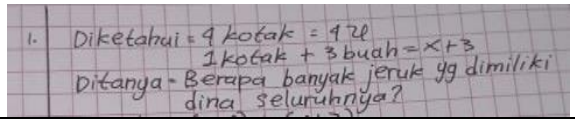
S1 : "We know that the length of the garden is $3x + 4$ meters and the width is $2x - 5$ meters."

P : "What is being asked in the question?"

S1 : "To find the area of the garden, sir."

Based on the students' work, there are scribbles on the section where they wrote down the information about the length of the garden. These scribbles indicate that the students had doubts when copying the information from the question. This type of error is often referred to in literature as a copying error or written representation error, where students do not consistently rewrite the data provided. Although in the S1 interview he was able to correctly state the length of the garden as $3x + 4$ meters and the width as $2x - 5$ meters, the scribbles on his answer sheet indicate that he experienced initial confusion when reading and understanding the information in the question. Thus, this error falls into the category of errors in the reading and initial representation stage, even though his conceptual understanding was correct when interviewed.

c. S2's comprehension error in question number 1



Translate
1. Given: 4 boxes = $4x$
1 box + 3 pieces = $x + 3$
Question: How many oranges does Dina have in total?

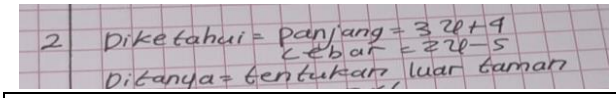
Figure 3. S2's work on question number 1

Excerpt from the S2 interview:

P : "After reading the question, what information do you know?"
S2 : "Dina has 4 boxes of oranges, then her father gives her 1 more box of oranges and 3 oranges."
P : "What is being asked in the question?"
S2 : "The question is about the algebraic form."

In the S2 assignment, it was observed that the student wrote "1 box + 3 pieces" before finally writing the algebraic form $x + 3$. This writing shows that the student was not yet able to directly replace concrete units with variable symbols, even though one box must be represented as x, so that the correct form is $x + 3$. This initial error is classified as a symbolization error, which is the inability to use algebraic notation correctly from the early stages of representation. Although S2 was able to write the correct expression at the end of the assignment, this initial error shows that he had difficulty in the comprehension stage, as explained in various studies that students often write information literally before converting it into standard mathematical form.

d. S2's comprehension error in question number 2



Translate
2. Given: length $= 3x + 4$
Width $= 2x - 5$
Question: determine the area of the garden.

Figure 4. S2's work on question number 2

Excerpt from the interview with S2:

P : "After reading the question, what information do you know?"
S2 : "We know that the length of the garden is $3x + 4$ meters and the width is $2x - 5$ meters, ma'am."

P : “What is being asked in the question?”
S2 : “Find the area of the garden, ma'am.”

The interview excerpt shows that subject S2 was able to understand the information given in question number 2. He was able to mention the known parts, namely the length of the garden is $3x + 4$ meters and the width is $2x - 5$ meters, and was able to identify that what was being asked was the area of the garden. This shows that S2 did not make any mistakes in the comprehension stage.

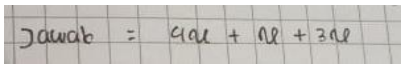
Overall, analysis of S1 and S2 shows that their comprehension abilities varied on both questions. S1 did not make any comprehension errors on question 1, as he was able to mention important information and understand the question correctly. However, on question 2, S1 showed comprehension errors, as seen from his scribbles and hesitations when copying information, even though in the interview he was able to explain the information correctly.

Meanwhile, S2 did not make any comprehension errors on question number 2, as he was able to state the known information and what was asked correctly. However, on question number 1, S2 made a comprehension error related to symbolization, as shown by his tendency to write down the information literally (“1 box + 3 pieces”) before converting it to the algebraic form $x + 3$, which indicates an initial obstacle in interpreting symbolic representations.

The analysis results show that comprehension errors did not occur evenly in both subjects, but appeared selectively in certain questions. Subject S1 experienced a comprehension error in question number 2. Conversely, subject S2 experienced a comprehension error in question number 1. Thus, each subject showed comprehension errors in certain questions.

3. Transformation Errors

   a. S1's transformation error in question number 1



Translate
Answer = $4x + x + 3x$

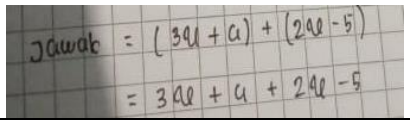
Figure 5. Results of S1's work on question number 1

Excerpt from S1 interview:
P : “What operation will you use to solve this problem?”
S1 : “Addition.”
P : “How do you convert the information in the question into mathematical form?”

S1 : "I write 4 boxes $4x$ then 1 more box x, then 3 additional oranges I write $3x$."

The interview excerpt shows that subject S1 is not yet able to transform the information in the question into the correct mathematical form. He wrote "3 oranges" as '$3x$' and combined all the information as variables, which shows that he does not yet understand the difference between variables and constants. In addition, S1 wrote the answer in the format "answer = $4x + x + 3x$", which shows that he used the equal sign as part of the answer label, not as a mathematical relation symbol. This writing is incorrect because the label "Answer" should be separated first, then the next line should begin with "= $4x + x + 3x$," or it should be written correctly as a mathematical model, for example, "Number of oranges = $4x + x + 3x$." This error confirms that S1 experienced a transformation error, both in converting verbal information into algebraic symbols and in using mathematical notation correctly.

b. S1's transformation error in question number 2



Translate
Answer = $(3x + 4) + (2x - 5)$
$= 3x + 4 + 2x - 5$

Figure 6. S1's work on question number 2

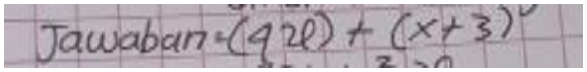
Excerpt from S1's interview:

P : "What operation will you use to solve this problem?"
S1 : "Addition, sir."
P : "How do you write the formula?"
S1 : "I write it directly, sir, length $(3x + 4)$ plus width $(2x - 5)$, sir."

The interview excerpt shows that subject S1 was incorrect in determining the operation to be used. He stated that he would use addition and immediately wrote "length $(3x + 4)$ plus width $(2x - 5)$", which shows that the subject did not understand the difference between the area formula and the perimeter formula. This error is even more apparent when S1 writes the answer in the form "answer = $(3x + 4) + (2x - 5)$", which shows that he uses the equal sign only as a marker for the answer, not to express the correct mathematical relationship. The writing should be separated, for example by writing "Answer" on a separate line, then the next line contains the appropriate mathematical model. This inaccurate writing shows that S1 made mistakes in the

transformation stage, both in choosing the correct formula for area and in using mathematical notation correctly.

c. S2's transformation error in question number 1



Translate
Answer = $(4x) + (x + 3)$
$= 4x + 3x = 7x$

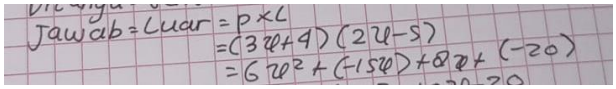
Figure 7. S2's work for question number 1

Excerpt from S2's interview:

P : "What operation will you use to solve this problem?"
S2 : "Addition, ma'am."
P : "How do you convert the information in the question into mathematical form?"
S2 : "The 4 boxes are $4x$, then 1 more box is x, then 3 additional oranges are written as $3x$."

The interview excerpt shows that subject S2 is able to transform the information in the problem into mathematical form. He can determine the operation to be used and explain how 4 boxes are written as $4x$, one additional box as x, and three oranges as a constant. This shows that S2 understands the difference between variables and constants and does not make mistakes in the transformation stage.

d. S2's transformation error in question number 2



Translate
Answer = area = $p \times L$
$= (3x + 4)(2x - 5)$
$= 6x^2 + (-15x) + 8x + (-20)$
Area $= 6x^2 - 10x - 20$

Figure 8. S2's work for question number 2

Excerpt from the interview with S2:

P : "What operation will you use to solve this problem?"
S2 : "Multiplication, ma'am."
P : "How do you write the formula?"
S2 : "I wrote it down directly, ma'am, length $(3x + 4)$ times width $(2x - 5)$."

The interview excerpt shows that subject SP-01 is able to choose the correct mathematical operation to determine the area of a rectangle. He mentions that the operation used is multiplication and can write the formula correctly, which

is to multiply the length $(3x + 4)$ by the width $(2x - 5)$." However, when writing the formula, SP-01 used the form "Area = p × L" with a capital letter 'L', whereas the correct notation is "Area = $p \times L$" with a lowercase letter "L" to indicate width. This error in the use of notation shows that S2 still makes mistakes in the aspect of writing mathematical symbols. Although conceptually he is not wrong in choosing the appropriate operation and formula, this notation error is still part of the transformation error because it is related to inaccuracy in writing the formula correctly.

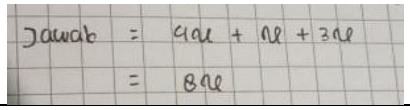
Overall, the transformation stage shows a clear difference between the two subjects. Subject S1 made transformation errors in both questions, number 1 and number 2. In question number 1, S1 incorrectly converted verbal information into a mathematical model by writing "3 oranges" as $3x$, thus failing to distinguish between variables and constants. In addition, S1 also wrote the answer in the form "Answer = $4x + x + 3x$," which shows the incorrect use of the equal sign as an answer marker, rather than a mathematical relation symbol. In question number 2, S1 again made a mistake by using the wrong operation. He added the length and width $(3x + 4) + (2x - 5)$ as if he were calculating the perimeter, not the area, thus demonstrating a lack of understanding of the appropriate formula to use. The incorrect use of the "=" symbol as the answer label also reappeared in this question.

Unlike S1, subject S2 did not make conceptual errors in the transformation stage, but still showed inaccuracies in writing notation. In question number 1, S2 was able to write the mathematical model correctly and distinguish between variables (x) and constants (3). In question number 2, S2 chose the correct operation and wrote the multiplication model between length and width correctly. However, he still made a notation error by writing the formula "Area = $p \times L$" using the capital letter "L," which should have been written as "Area = $p \times l$" with a lowercase letter to represent width. Although this was not a conceptual error, this inconsistency in notation was still categorized as a transformation error in terms of mathematical symbol writing.

Thus, transformation errors were predominantly found in S1, both in the selection of operations, the conversion of information into algebraic form, and the use of mathematical symbols. Meanwhile, S2 had mastered the transformation process conceptually, but still needed to improve accuracy in notation to comply with the rules of correct mathematical writing.

4. Processing Skill Errors

a. Processing ability error S1 on question number 1



Translate
Answer = $4x + x + 3x = 8x$

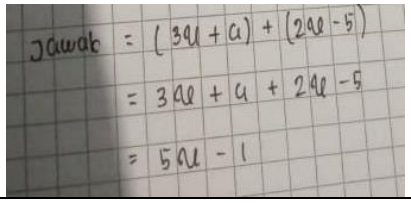
Figure 9. Results of S1's work on question number 1

Excerpt from S1 interview:

P : "What is the first step you will take to solve this problem?"
S1 : "I write down what is known first."
P : "Try to explain step by step how to solve this problem!"
S1 : "I write $4x$ as 4 boxes and then add x for 1 more box, then I write $3x$ for the 3 additional oranges. Then I add them up."
P : "How do you do this calculation?"
S1 : "I combine all the x 's, so it's $8x$."

The interview excerpt shows that subject S1 can correctly perform the procedure of adding like terms. He is able to combine terms containing the variable x and explain his calculation steps in sequence. However, an error occurred at the transformation stage when S1 wrote "3 oranges" as "$3x$". This shows that S1 made a mistake in writing down the process on the answer sheet.

b. Error in S1's processing ability on question number 2



Translate
Answer = $(3x + 4) + (2x - 5)$
$= 3x + 4 + 2x - 5 = 5x - 1$

Figure 10. S1's work on question number 2

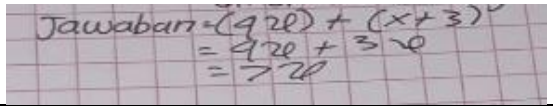
Excerpt from the interview with S1:

P : "What is the first step you will take to solve this problem?"
S1 : "First, I write down what is known and asked, then I enter the formula."
P : "Try to explain step by step how you solved this question!"
S1 : "I wrote $(3x + 4) + (2x - 5)$, then added them together, combined the x's to get $3x + 4 + 2x - 5$, then combined the regular numbers to get -1."
P : "How did you do this calculation?"
S1 : "I combined the like terms."

The interview excerpt shows that subject S1 was able to correctly perform the operation of adding like terms. He was able to explain the calculation steps and

combine like terms without procedural errors. However, an error occurred because from the beginning he chose the wrong calculation operation, which was to add the length and width, when the correct operation to determine the area is multiplication. This shows that S1 made an error at the processing ability stage.

c. Processing ability error S2 on question number 1



Translate
Answer = $(4x) + (x + 3)$
$= 4x + 3x = 7x$

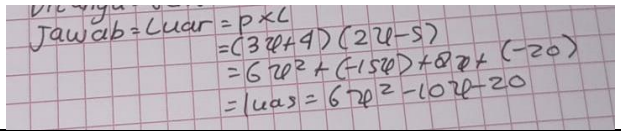
Figure 11. S2's work on question number 1

Excerpt from S2's interview:

P : "What is the first step you will take to solve this problem?"
S2 : "I write down what is known and what is asked, ma'am."
P : "Try to explain step by step how to solve this problem!"
S2 : "I wrote 4 boxes as $4x$, then 1 more box as x, then 3 additional oranges as 3."
P : "How did you perform this calculation?"
S2 : "There are two parentheses, right? $4x$ and x+3. So, I added $x + 3$ first, so it became $4x + 3x$."

The interview excerpt shows that subject S2 made a mistake in the processing stage. He was able to write down the initial information correctly, but made a mistake when performing the calculation. The subject thought that the expression $x + 3$ should be multiplied, not added, so his calculation was wrong. This mistake occurred due to a lack of accuracy and understanding in performing algebraic operations.

d. S2's processing ability error in question number 2



Translate
Answer = area = $p \times l$
$= (3x + 4)(2x - 5)$
$= 6x^2 + (-15x) + 8x + (-20)$
Area $= 6x^2 - 10x - 20$

Figure 12. S2's work on question number 2

Excerpt from S1's interview:

P : “What is the first step you will take to solve this problem?”
S2 : “Write down the formula for the area of a rectangle, ma'am.”
P : “Try to explain step by step how to solve this problem!”
S2 : “So $= (3x + 4)$ and $(2x - 5)$ are multiplied, then the result is $6x^2 - 10x - 20$”
P : “How did you do this calculation?”
S2 : “Just multiply, then add and subtract.”

The interview excerpt shows that subject S2 made a mistake in the processing stage. Although he knew that the steps to solve the area of a rectangle were to multiply $(3x + 4)$ and $(2x - 5)$, he made a mistake when processing the algebraic calculation. The subject combined the terms $-15x$ and $8x$ into $-10x$, which indicates an error in the addition of like terms.

Overall, the processing stage shows a difference in error patterns between the two subjects. S1 processed the procedure correctly but used the wrong mathematical model, resulting in an incorrect solution. Conversely, S2 chose the correct mathematical model but made a mistake in carrying out the procedure due to a lack of thoroughness in adding or combining terms. Thus, the processing error in S1 occurred due to a transformation error, while S2's error stemmed from a lack of thoroughness in the calculation stage.

5. Answer Writing Errors

a. Error in writing the answer to question 1 by S1

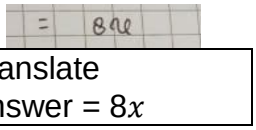


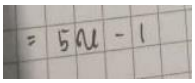
Figure 13. Results of S1's work on question 1

Excerpt from the interview with S1:

P : “What is the final result of solving this problem?”
S1 : “$8x$”
P : “Does your answer match what is asked in the question?”
S1 : “Yes, sir.”

This interview excerpt shows that subject S1 was unable to write the final answer in accordance with the question. When asked to state the final result, S1 answered “$8x$” and believed that the answer was correct. This shows an error in the answer writing stage, namely the inability to express the final result accurately as requested in the question.

b. S1's error in writing the answer to question number 2



Translate
Answer $= 5x - 1$

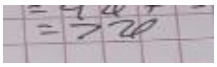
Figure 14. S1's work on question number 2

Excerpt from the interview with S1:

P : "What is the final result of this question?"
S1 : "$5x - 1$"
P : "Is your answer correct according to the question?"
S1 : "Yes, sir."

The interview excerpt shows that subject S1 was unable to write the final answer as requested in the question. When asked to state the final result, S1 answered "$5x - 1$" and believed that the answer was correct. This indicates an error in the answer writing stage, namely the inability to write the final result correctly.

c. Error in writing the answer by S2 in question number 1



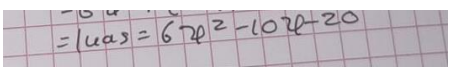
Translate
Answer = $7x$

Figure 15. S2's work on question number 1

Excerpt from the interview with S2:
P : "What is the final result of this question?"
S2 : "$7x$"
P : "Is your answer correct according to what is asked in the question?"
S2 : "Yes."

The interview excerpt shows that subject S2 was unable to write the final answer as requested in the question. When asked to state the final result, S2 answered "$7x$" and believed that the answer was correct. This indicates an error in the answer writing stage, namely the inability to express the final result accurately.

d. S2's error in writing the answer to question number 2



Translate
Answer = Area $= 6x^2 - 10x - 20$

Figure 16. S2's work on question number 2

Excerpt from interview with S1:

P : "What is the final result of this question?"
S2 : "$6x^2 - 10x - 20$"
P : "Is your answer correct according to what is asked in the question?"
S2 : "Yes"

The interview excerpt shows that subject S2 was unable to write the final answer as requested in the question. When asked to state the final result, S2 answered "$6x^2 - 10x - 20$" and believed that the answer was correct. This shows that there was an error in the answer writing stage, namely the inability to write the final result correctly.

Overall, the answer writing stage shows that DS wrote the wrong final answer because the previous model and process were also wrong, so the error was comprehensive from start to finish. Meanwhile, SK made a mistake due to procedural carelessness even though he understood the correct mathematical model. Thus, it can be concluded that DS made a mistake in writing the answer due to a conceptual error since the transformation stage, while SK's mistake was more due to an operational error that affected the final result.

Based on the analysis results, neither student made any errors in the reading or comprehension stages. Both were able to recognize the information contained in the questions and understand what was being asked. However, differences began to appear in the transformation stage, process skills, and writing answers. A summary of the error analysis results is shown in Table 1.

Table 1. Types of Student Errors Based on Newman's Procedure

Subject	Question No.	Newman Error Type				
		Reading Error	Comprehension Error	Transformation Error	Processing Ability Error	Answer Writing Error
S1	1	-	-	✓	✓	✓
	2	-	✓	✓	✓	✓
S2	1	-	✓	-	✓	✓
	2	-	-	✓	✓	✓

Analysis of students' errors in solving algebraic story problems based on Newman's procedure shows different patterns of errors in each subject. At the reading stage, both S1 and S2 did not show any obstacles. Both were able to recognize all written information, understand the terms used, and interpret algebraic symbols correctly. This was evident from their ability to recall important information in the questions and

explain the meaning of the symbol x without showing any signs of confusion. Thus, the reading stage was not a source of errors for both students.

Differences began to emerge when students entered the comprehension stage. On the first question, S1 demonstrated good comprehension by identifying important information and understanding that the question required an algebraic form. However, on the second question, S1 seemed hesitant when copying the information about the length of the garden. The scribbles on the answer sheet showed that he was inconsistent in rewriting the data from the question. Although he was able to explain it correctly verbally, this carelessness indicated an initial representation error, which is categorized as a minor comprehension error. In contrast, S2 did not make a mistake on the second question but showed a misconception on the first question. He wrote down the information "1 box + 3 pieces" literally before converting it to the algebraic form $x + 3$. The inability to immediately perform this symbolization indicates an error in understanding algebraic representation, so that S2 experienced a comprehension error related to the symbolization process. Thus, it can be concluded that errors at the comprehension stage did not occur evenly. S1 only made a mistake on the second question, while S2 experienced it on the first question.

The transformation stage is the most striking part in distinguishing the abilities of the two subjects. S1 shows transformation errors in both questions. In the first question, he converted "3 oranges" into $3x$, thus failing to distinguish between variables and constants. In addition, the writing "Answer $= 4x + x + 3x$" shows that S1 used the equal sign as an answer marker, not as a mathematical relation. A similar error appeared in the second question when he chose the addition operation to determine the area of the garden. He wrote $(3x + 4) + (2x - 5)$ as if calculating the perimeter, not the area, making it clear that S1 did not succeed in choosing the appropriate formula. This condition confirms that S1's transformation error is conceptual and consistent in both questions. On the other hand, S2 did not show any conceptual errors in the transformation stage. He was able to choose the right operation, convert the information into the correct mathematical model, and understand the difference between variables and constants. However, S2 still made minor errors in notation, for example, using the capital letter "L" to denote width, whereas the standard notation uses the lowercase letter "l". Although it does not affect the concept, this inconsistency is still classified as a transformation error in the use of mathematical notation.

At the process skill stage, the mistakes made by students are greatly influenced by mistakes made at the previous stage. S1 was able to correctly add similar terms in the first and second questions, so procedurally he did not make any calculation errors. However, because the transformation error had already occurred at the beginning, the correct calculation mechanism still produced an overall incorrect answer. In the second question, he continued the long and wide addition procedure, which was incorrect from the start, so that the process error did not stem from his ability to calculate, but rather from the incorrect application of operations. Meanwhile, S2 demonstrated good process skills in both questions. He was able to operate algebra, multiply terms, and simplify algebraic forms correctly. Minor notation errors did not interfere with the calculation process, so the final results were still mathematically correct. Thus, procedural errors only occurred in S1 and did not occur in S2.

Thus, the overall analysis shows that S1 tends to make conceptual errors from the transformation stage to the writing of answers, while S2 makes more errors in aspects of accuracy such as initial symbolization and final simplification. Neither student made reading errors, but they had different weaknesses in the stages of comprehension, transformation, process, and writing of answers.

Conclusion

Based on the results of the study conducted on seventh-grade students at MTsN Kota Batu in the 2025/2026 academic year, it can be concluded that students made several types of errors in solving story problems on algebraic operations based on the Newman procedure. Of the five stages of Newman's errors, it was found that there were no errors in the reading and comprehension stages. However, students still made errors in the transformation, process skills, and answer writing stages.

Overall, the types of errors between S1 and S2 showed quite clear differences. S1 made errors in the transformation, process skills, and answer writing stages. Errors in the transformation stage were mainly caused by the inability to convert information into the correct mathematical model, which led to further errors in the processing and final answer stages. Meanwhile, S2 did not experience errors in the reading, comprehension, or transformation stages. S2's errors appeared in the processing and writing of answers stages, which were generally procedural in nature and caused by carelessness in performing algebraic operations.

The results of this study indicate that even though students were able to understand the content of the questions well, there were still obstacles in converting information into mathematical models and in performing calculation procedures correctly. Therefore, a learning approach is needed that focuses on strengthening transformation skills and accuracy in algebraic operations, as well as exercises that emphasize a continuous understanding of basic concepts.

Declarations

Competing Interests

The authors state that they have no conflicts of interest related to the publication of this work.

Data Availability

The data supporting the findings of this study can be obtained from the corresponding author upon reasonable request.

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