

Students' Error in Solving Word Problems in One-Variable Linear Equation Material at SMP Islam Darul Ulum Ulum based on Gender

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Abstract. Errors are deviations made by students towards the actual results (predetermined answers). Errors in learning are divided into three parts, namely conceptual errors, procedural errors, and technical errors. One of the factors that affect learning mathematics is gender. This study aims to describe the errors of male and female students in solving word problems in the material of One-Variable Linear Equations (PLSV). This research method uses a qualitative approach with a descriptive method. The subject selection technique was carried out by classifying students based on gender, so that 2 male students and 2 female students were obtained whose middle-test score was below 75. Then for the data collection technique, a paper-word problem-test is used, interviews, and *think aloud*. The analysis of the validity of the data in this study uses triangulation methods, namely the paper-based test, *think aloud* and interview methods. The results of this study show that male students experience errors in solving word problems of the One-Variable Linear Equation (PLSV) material on conceptual and procedural errors, while female students experience errors in solving one-variable linear equation (PLSV) material word problems on procedural errors.

Keywords: Gender; Errors; PLSV; Word Problem

A. INTRODUCTION

Errors are deviations from the truth that students do into a form of difficulty that they experience when learning (Santi & Sudihartini, 2019). Furthermore, Sudihartini (2018) revealed that error is a deviation from accuracy or truth. Error is a deviation of a person who already believes that something is valid and has been agreed upon together before (Kosasih, 2020). An error is an irregularity made in completing a previously determined job (Mauliandri & Kartini, 2018). Ardiawan (2015) stated that error is a form of deviation from the actual answer that is systematic. Therefore, students' error when solving problems in mathematics are deviations from the actual results. Based on this presentation, it can be concluded that the error is the deviation made by the student to the actual result (the answer that has been determined).

Student errors in learning are very diverse, as stated by Maseko (2015), errors are divided into three, namely *slip* (careless), *conceptual error* (conceptual error) and *procedural error* (procedural error). Meanwhile, according to Kiat (2005) there are three parts of learning errors, namely conceptual, procedural, and technical errors. Conceptual errors are student errors caused by not being able to determine the formula and stages of solving problems, while procedural errors are students' inconsistencies in determining the solution steps and not being able to solve the problem to the end, while technical errors are errors in determining number operation signs, errors in calculating or determining coefficients, variables, and constants (Raharti & Yuniarta 2020). The indicators of conceptual errors include (a) errors in determining formulas, (b) not being able to write formulas, indicators of procedural errors are two, namely (a) not writing the solution steps correctly, (b) not writing the conclusion of the final answer, and there are two indicators of technical errors,

(a) errors in calculating number operations, (b) errors in writing variables and constants (Ndek, et al., 2022).

Knowing the errors and the causes is very important, because it is to correct and minimize the errors made by students (Kamagi & Runtu, 2020). Error analysis is carried out in order to correct and minimize the chances of student errors and become information for teachers for consideration purposes in maximizing learning (Kalengkongan, et al., 2021). Therefore, research on errors is very important, because it can help teachers in establishing the right methods and steps on learning to prevent continuous errors (Brown & Skow, 2016). Based on this presentation, it can be interpreted that knowing students' errors is an important thing that must be done in order to minimize the errors that occur and can be evaluated in learning, especially in mathematics learning.

Mathematics learning is closely related to daily life which is packaged in the form of word problems (Kalengkongan, et al., 2021). Word problems are questions that are conveyed in the form of short stories using the language of everyday life (Amalia, et al., 2018). Budiyo (2008) revealed that the word is manifested in sentences in which hidden problems or conflicts are solved using numeracy skills. The application of word problems in mathematics lessons to students is very important, as has been stated by Jumiati & Zanthi (2016) that whether or not the mathematics learning results are achieved or not can be observed by the way students understand and complete a math problem, especially using word problems. Implementing learning using example word problems will be able to improve students' creative thinking skills (Pratiwi, et al., 2021). Word problems are very important to learn to find out students' mastery of the material and error analysis is needed in solving word problems as evaluation material (Yunarti & Almira, 2022).

The word can be taken from the material of the One Variabel Linear Equation (PLSV). Therefore, the researcher conducted a study on students' errors in solving word problems in the One-Variable Linear Equation (PLSV) material. PLSV is the initial material of algebraic concepts that are very important to understand before learning advanced algebra (Nafii, 2017). One-variable linear equations (PLSV) are mathematics materials that must be studied by grade VII students (Nasriadi, 2016). PLSV material is very important to be studied and understood by students, because its application is very related to daily life, for example in the process of buying and selling and dividing time in completing a job (Nasriadi, 2016). Thus, PLSV material is important for students to understand, because it is the basis of algebra material. However, there are still many students who make errors in solving word problems in PLSV material. This is in line with what Mariyam, et al. (2018) explained, that students tend to be wrong when asked to solve word problems in PLSV material. Therefore, research related to students' error in solving word problems in PLSV material is very important to be carried out.

The fundamental errors in solving word problems of PLSV material is that students cannot mention constants and are wrong in mentioning constants (Sapitri et al., 2022). Students still experience many errors in solving PLSV problems because they are influenced by mathematics learning factors. The factors that affect learning mathematics include willingness, teacher readiness, student readiness, intelligence, ability, curriculum, presentation method, and student gender factor (gender) (MZ, 2013)

Gender differences certainly cause physiological differences and affect psychological differences and have an impact on learning (Latief et al., 2019). Male and female students have different characteristics in solving a problem (Savitri & Yuliani, 2020). According to Hafidz. (2019) The difference in male and female sex affects students' mathematics learning outcomes. Gender differences will have an effect on solving math problems (Nurjannah et al., 2021). According to Amin, et al. (2021) gender differences need to be considered in the mathematics learning process. Based on this statement, gender differences will affect the mindset and way students solve problems, so gender differences need to be considered in learning, especially in mathematics learning. Based on this statement, gender differences affect the mindset and way students solve problems, so gender differences need to be considered in learning, especially in mathematics learning.

In this study, the researcher made preliminary observations on November 15, 2022. Preliminary observation conducted by researchers at SMP Islam Darul Ulum Sumenep on 15 grade VIII students. In the preliminary observation, the 15 students made errors in solving the One Variable Linear Equation (PLSV) word problems. From the results of preliminary observations, it can be seen

that students' errors in solving PLSV word problems are wrong in modelling word problems in the form of mathematical concepts, wrong in determining number operations and wrong in determining the final answer result.

Based on those explanations, the researcher conducted research to identify students' errors in solving word problems in PLSV material. This research identifies errors that are often made by students, so that the difficulties and problems faced by students can be known. In this study, the researcher identified students' errors in solving word problems in one-variable linear equation material by reviewing from gender. The novelty in this study is found in the research material, namely the One-Variable Linear Equation (PLSV) and the assessment of gender. Therefore, this research is expected to be able to help teachers in overcoming problems that exist in students in the process of solving word problems.

B. METHOD

The method used in this study is to use a qualitative approach because the research is carried out directly to the data source. The data collected is in the form of verbal data in the form of written and oral. The type of research used in this study is a type of descriptive research. For the focus of the research, the researcher took data at the Dharul Ulum Dasuk Timur Islamic Junior High School, Sumenep regency in the 2022/2023 school year. The subject of the study was taken from grade VII students of Dharul Ulum Dasuk Timur Islamic Junior High School, Sumenep regency whose UTS score was below KKM (75). The research instruments in this study are divided into two, namely the main instrument in the study is the researcher himself and the supporting instrument consisting of a test sheet (written test) and an interview guideline. The data collection techniques used are written tests, interviews and Think Aloud. In addition, to test the validity of the data, the researcher used a method triangulation technique, which is to test the data with different methods from the same source. Meanwhile, the data analysis techniques used are in the form of data reduction, data presentation and conclusion drawn.

C. RESULTS & DISCUSSION

The results of the research conducted by the researcher showed that male students experienced conceptual and procedural errors. The female students experienced procedural errors. This is based on the results of the students' work on the written test given, corroborated by the results of interviews and *students' think aloud*. The errors of male students and female students are presented in Table 1.1 below.

Table 1.1 Errors of Male Students and Female Students

Subject	Errors		
	Conceptual	Procedural	Techniques
Male (SL)	√	√	
Female (SP)		√	

1. Male Students' Errors in Solving PLSV Word Problems

When male students (SL) are given PLSV word questions, male students immediately read and understand the questions. In solving word problems, male students write equations from word problems by experimenting. The results of the work of male students in answering test questions in the form of word questions are shown in **Figure 1.1** below;

1. $7x : 20 = 4 + 10$
 $7x + 20$
 $7x + 10 : 4 = 20$

There's 3 equation

$7 : 10 = 10 : 1 = 20 = 1$
 SL made an error in number operation

Figure 1.1 SL Answer

In **Figure 1.1**, the male student writes a word problem in the form of an algebraic equation. However, the equation in **Figure 1.1** is the result of an experiment conducted by male students. The first step taken in the process of solving the word problem, the male student tried to make an algebraic equation from the problem. This is reinforced by the following excerpt of the interview;

Q : "how can you come up with the equation ($7x : 20 = 4 + 10$)?"

SL: "7x is 7 baskets of Yuli oranges, divided by 20 because Yuli's oranges are divided among her 20 friends, equal to 4 because each person gets 4 oranges and plus 10 because Yuli's oranges are less and plus 10 oranges by her mother."

Q : "Are you sure the equation you wrote is correct?"

SL : "No, it's just a trial and error"

Q : "how can you come up with the equations that are in the answer sheet?"

SL: "This is 7x divided by 20 equal to 4 plus 10. 7x divided by 20 can't, because it's odd, so I tried to make $7x + 20$ and this still can't, because the result of 7 plus 20 is still odd. Then I tried again $7x + 10$, because 7x is a yuli orange and 10 is a citrus given by his mother. Then divided by 4 because each child gets 4 oranges, so that later it will be equal to 20, namely many of Yuli's friends who are distributed oranges equally."

The equations written by male students consist of three equations. Of the three equations, the first and second equations are considered wrong, because they are not in accordance with expectations. The one used to find the many oranges in each basket is the 3rd equation. This is reinforced by the following excerpt of $7x \div 20 + 10$, $7x + 20$ $7x + 10 \div 4 = 20$ the think aloud transcript;

" $7x + 4 = 10$, eemm wrong. So Seven baskets, which is 7x, Yuli gave oranges to 20 of her friends, so 20 were distributed and each child got 4 pieces, so it was equal to 4. But here 10 is added by the heck, so + 10 ($7x \div 20 = 4 + 10$)... (re-read the question). Try $7x + 20$, but this still can't be done, because the results are still odd. (read the question again) So 7x try to add 10, then 4 is distributed equal to 20, because there are 20 friends of Yuli who each get 4 oranges. Continue.. (see question) Judging from 7 baskets plus 10, 4 will be distributed so that the result is 20 ($7x + 10 \div 4 = 20$)"

The snippet of the *think aloud* transcript explains the process carried out by male students in writing word problems in the form of algebraic equations. This is also strengthened by the following excerpt of the interview transcript;

Based on the results of the written test answers in **Figure 1.1**, snippets of *think aloud* transcripts and snippets of interview transcripts, male students still experience conceptual errors in changing word questions into PLSV concept forms. The error was caused because male students did not understand the concept of equality. The error of male students in understanding the concept of equality is due to the fact that in writing the equation, male students divide the total number of oranges by the many oranges that each person obtains so that it is equal to many people who obtain oranges. It is written in the form of an equation $(7x + 10) / 4 = 20$. In the equation, there is a total number of oranges divided by 4 oranges, but equal to 20 people. So, between one segment and another, it is not the same. Because one segment is a lot of oranges and the other segment is a lot of people. Therefore, male students experience conceptual errors, namely in the indicators of not being

able to determine and write the concept of PLSV correctly.

In addition to conceptual errors, male students also experience procedural errors. The procedural errors of male students are, not being able to carry out the completion stage systematically and not being able to perform algebraic operations. This is also shown in **Figure 1.1**. In **Figure 1.1**, after writing the word problem in the form of a PLSV equation, the male students immediately look for the final result using number operations. The number operation written is . Number operations are a method used by male students to obtain final grades. Before performing the number operation, the male students tried to replace the variable with 10. After substituting 10 with, the male student performs a number operation, i.e. multiplying 7 by 10, the result of adding 10 is then divided by 4. From the operation the number () is equal to 20. So that each basket contains 10 oranges. This is stated in the following excerpt of = $7 = 10 + 10 \div 4 = 20 = 107 = 10 + 10 \div 4 = 20 = 10 \times 7 \times 10(7 \times 10 + 10)/4$ the think aloud transcript ;

"Try x equals 10, so 7×10 then add 10 and divide by 4. It turns out to be true, if x equals 10 the result is 20. So that each basket contains 10 oranges."

In **Figure 1.1** SL ends the number operation by equal to 10. Equal to 10 in the last part of the number operation indicates that if $x=10$ then the result is equal to the equation, which is equal to 20. Thus, the male students concluded that each orange in the basket was 10 pieces. The explanation is in line with the following excerpt from the interview.

Q "what does it mean by ?" $7 = 10 + 10 \div 4 = 20 = 10$

SL: "I tried $x=10$ so that 7 multiplied by 10 then added 10 and divided by 4 so it equals 20. So = 10 is the result if each shell contains 10 oranges."

From the male students' answers in **Figure 1.1**, it is reinforced with snippets of interview transcripts and snippets of think aloud transcripts explaining the process of obtaining the final answer. Male students looking for final grades do not use algebraic operations. This is because SL cannot operate the equation contained in **Figure 1.1**.

As a result of the inability of male students to perform algebra operations, male students are unable to write the completion process systematically. After writing the equation in **Figure 1.1**, the male student immediately performs the number operation as in **Figure 1.1** to obtain the final score. Thus, male students experience procedural errors in the indicator of not being able to systematically solve the problem.

Based on the presentation of the results of the male students' work on the word problems contained in **Figure 1.1**, reinforced by the existence of think aloud transcripts and interview transcripts, male students experienced conceptual and procedural errors. The conceptual error of male students is found in the indicator of not being able to determine and write the concept of PLSV correctly. Meanwhile, procedural errors of male students are found in two indicators, namely, not being able to perform algebraic operations correctly and not being able to write the completion process systematically.

In the process of solving the PLSV word problem, the male student experienced a conceptual error. Male students do not fully understand the meaning contained in the questions. Therefore, male students experience conceptual errors. As stated by Jana (2018), conceptual error is a error in understanding the definition or initial understanding. In addition to not being able to understand the problem completely, male students also cannot convert the problem into mathematical concepts and cannot determine the concepts applied. This is in line with what Kiat (2005) stated that conceptual errors are errors that occur because students do not understand concepts and do not know the right concepts to solve mathematical problems, the error is found in one of the indicators put forward by Raharti & Yuniarta (2020), i.e. Students cannot apply formulas. This happened after SL2 reasoned and made equations, but did not understand the wordline contained in the problem.

In addition to conceptual errors, male students also experience procedural errors. Procedural errors, which are errors that occur due to students' inability to manipulate or solve mathematical problems, even though they have understood the concept behind the given problem (Kiat, 2005). In working on PLSV word problems, male students cannot write and complete the completion stage and cannot solve with algebraic forms. This is in line with the indicators of procedural errors conveyed by Ndek, et al. (2022) by dividing them into two indicators, namely (a) not writing the finishing steps correctly, (b) not writing the conclusion of the final answer. Male students have difficulty and are

confused in writing down the steps to solve the problem. So they chose to directly write down the final answer obtained from the results of number operations without performing algebraic operations.

Based on the description above, students with the male gender experience conceptual and procedural errors in solving word problems. These conceptual errors include not being able to apply the concept correctly, lack of understanding the implementation of the given word problem in the form of an equation. In line with the statement of Fausan et al., (2019) that male students experience conceptual errors because they do not understand and do not apply concepts. According to Tadda. (2016) Conceptual errors in male students are very high, with a percentage of conceptual errors (76%) in solving algebraic problems. The procedural errors made by male students are not able to carry out the completion stage systematically. Procedural errors are errors in ordering a mathematical symbol and improper steps in solving a problem (Fajrul et al., 2022). According to Tadda. (2016) procedural errors Male students are unable to write down the steps in solving a problem or the inability to manipulate those steps.

2. Female Students' Errors in Solving PLSV Word Problems

When female students (SP) were given a word problem of One Variable Linear Equation (PLSV) to be held, SP immediately read and tried to understand the problem. In the process of solving question number 1, the SP writes the important points contained in the question. Write what is known in the question to make it easier to change the word question into the form of a PLSV concept. After writing the points known in the problem, the SP makes an equation or writes a word in the form of a PLSV concept. The equation obtained is found in the following **Figure 1.2** ;

$$\frac{7x + 10}{20} = 4$$

$$= 20 \times 4 = 80$$
~~$$= 7 + 10 = 17$$~~

$$= 10 \text{ setiap keranjang}$$

Procedural errors

Figure 1.2 SP1 Answer

Figure 1.2 shows that after writing the important points in the problem, the SP immediately writes down the equation or PLSV concept from problem number 1. The equation was obtained from 7 baskets of oranges owned by Yuli and added to 10 oranges given by Yuli's mother then divided by 20 Yuli's friends so that it was equal to 4. This is conveyed in the following excerpt of *the think aloud* transcript ;

Q : "How do you write down the equations in the answer?"

SP : "Here it is obtained from Yuli's basket of oranges plus because 10 oranges were added by her mother which was divided among her 20 friends so that it is equal to 4 because each child gets 4 oranges" 7×10

In **Figure 1.2**, before making the PLSV concept, the SP did not do any reasoning. However, in the excerpt of the interview transcript, the SP understands in determining the variables by reasoning. SP attributed the many citrus fruits in each basket to the same This was reinforced by the abduction of the following interview transcript

Q : "What are you assuming with?" x

SP : "There are a lot of citrus fruits in your basket."

After writing the word problem into an algebraic form, SP immediately performs a number operation to obtain the final answer score. In **Figure 1.2**, the SP immediately performs a number operation to obtain the final answer. SP cannot systematically write the completion stages according to the way of solving algebraic operations. This is in line with the following excerpt of *the think aloud* transcript;

"..... then calculated. Because Yuli wanted to give oranges to 20 of her friends and each child got

4 oranges, 20 was multiplied by 4 so that the result was 80. Meanwhile, Yuli's mother gave 10 oranges so that Yuli could divide the oranges evenly with her friend and here there were 7 baskets. 4 multiplied by 20 equals 80, because Yuli was given 10 oranges, then 80 minus 10 equals 70. Because here there are 7 baskets of oranges, each basket contains 10 oranges."

An excerpt of the transcript of the *think aloud* teserse, SP explained the steps to obtain the final answer. SP immediately uses a calculation operation by multiplying 20 by 4 then subtracting by 10 and dividing by 7. This is reinforced by the following excerpt of the interview transcript;

Q : "Why do you multiply 20 by 4?"

SP : "Because 20 is Yuli's many friends, each child gets 4 oranges"

Q : "Then what steps did you take after that?"

SP : "I subtracted the result from 20 times 4 by 10"

Q : "Why did you reduce 10?"

SP : "Because Yuli's oranges were less and 10 oranges were added by her mother, so the total number of oranges distributed by Yuli was reduced by 10"

Q : "Why do you write each basket of 10 oranges?"

SP : "Because 70 divided by 7 according to the number of baskets Yuli has"

In addition to not being able to write answers systematically, SP is also unable to perform algebraic operations correctly in the number 1 problem solving processor. The statement is in line with the following excerpt of the interview transcript;

Q : "Then how do you operate the equations that are written?"

SP : "I can't operate the equation, I immediately find the total number of oranges that Yuli has by multiplying 20 by 4"

Based on the results of the SP's answer contained in **Figure 1.2** which was reinforced with snippets of interview transcripts and *think aloud transcripts*, the SP experienced procedural errors, namely not being able to perform algebraic operations correctly and not being able to systematically complete the steps to obtain the final answer. Procedural errors are errors in ordering a mathematical symbol and improper steps in solving a problem (Fajrul et al., 2022). In procedural errors, female students experience quite high errors. This is in line with Tadda's statement. (2016) that female students experienced a percentage of procedural errors of (84%) in solving algebraic problems.

D. CONCLUSION

Based on the results and discussion, it can be concluded that male students have errors in solving the word problems of the One Variable Linear Equation (PLSV) material, namely conceptual errors in the indicators of not being able to carry out the PLSV concept correctly, not being able to determine and write the PLSV concept correctly. Procedural errors in indicators cannot perform algebraic operations correctly, cannot systematically write the stages of completion and cannot determine the final answer. The female students experienced errors in solving the word problems of the One-Variable Linear Equation (PLSV) material, namely procedural errors in the indicators, not being able to perform algebraic operations correctly and not being able to systematically solve the steps to obtain the final answer. From the results of this study, the researcher recommends that further research can analyze students' mistakes in the process of solving word problems of the One-Variable Linear Equation (PLSV) material by using reviews from different aspects. In addition, advanced research can also analyze errors by using certain methods

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