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Analyzing Students' Error in Problem Solving of Two-Variable Linear Equation System: A Case Study of Grade Eight Students of Indonesian Junior High School

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Abstract. This research aims at describing errors as well as knowing the factors causing students to make an error in solving problems in the material of the Two-Variable Linear Equation System (SPLDV). This research involved 31 students from grade eight students of Indonesian junior high school. To collect the data, tests, observation, and interview methods were used. The data validity was triangulation in which it required a comparison of data with interviews. The technique of data analysis was in three stages, starting from data reduction, data presentation, and conclusion. The analytical framework was developed based on the Newman error category. The results obtained are three types of errors, namely error understanding problems, transformation errors, and process skills errors. Factors causing these errors, in general, are students who find difficulties to acknowledge the meaning of the questions, students have a low level of understanding and creativity in identifying problems into mathematical models, and students' carelessness in process skills.

Keywords: Students' Error; Mathematics Education; Two-Variable Linear Equation System.

1. Introduction

The term of mathematics is very identic with the basic science that consists of counting and reasoning aspects, and this science is developing so fast with evidence of the increasing number of mathematical activities used in daily life (Erhardt, 2018; Nordin & Boistrup, 2018; Hornburg, 2018). Mathematics has several characteristics, namely having abstract objects, having symbols, agreement, and axiomatic deductive thinking, obeying the principle, and universality being the limiting discussion (Wasserman, 2018; Prast, 2018; Zhang et al., 2018; Maher et al., 2018). By paying attention to this theory, students in learning mathematics can experience difficulties. Difficulties in learning are the cause of the error. The adverse effects of student errors in completing mathematical problems make learning achievement achieved by students is still low (Swanson, 2016; Ramirez et al., 2016; Ng, 2017; Swanson, 2019; Liu et al., 2019).

Also, mathematics among students is considered the most challenging and even frightening subject when, in fact, mathematics is an exact science. In mathematics, there is a clear path, an explicit formula, and also one branch of science that is applicable in helping to solve everyday life. The reason for the need to study mathematics is because mathematics is a means of clear and logical thinking (Goldin-Meadow et al., 2012; Koponen, 2019; Silinskas & Kikas, 2019; Galindo et al., 2019). Means of solving everyday problems, a method of recognizing patterns of relationships and generalizing experiences, a means of developing creativity, a factor of increasing awareness of cultural development.

Two-Variable Linear Equation System is a system/unit of several linear equations of two similar variables. The material is related to terms, coefficients, constants, and variables. No doubt, this System of Two-Variable Linear Equation is often used to solve problems around us. In learning mathematics in school, the error is commonly made by students. Therefore, clear information is needed in connection with student difficulties, especially in answering the problem of Linear Equations Two Variables to improve the ability in the field of mathematics. The information is used to meet alternative learning that aims to reduce the errors students experienced.

According to Soedjadi (2011), from the error made by students in the Two-Variable Linear Equation System, several types of errors can be classified, including: (1) procedural errors in using Algorithms (work procedures), for example error in calculating operations; (2) error in organizing data, for example error in writing what is known, what is asked of a problem. Error sorting, grouping and presenting data; (3) errors in the use of symbols, tables and graphics that contain information; (4) errors in mathematical manipulation (errors in using/applying rules, traits in solving problems); (5) error in drawing conclusions (eg failure in writing conclusions from issues they have worked on).

Two-Variable Linear Equation is a material that requires a solution with a relatively high level of accuracy because there are several ways in the process of completion, especially in determining the value of a variable. Therefore, many

students have difficulty and make an error in determining the value of variables. Based on informal interviews conducted with several mathematics teachers in Jawa Tengah, Indonesia, information was obtained that the difficulty of students in mathematics, namely Two-Variable Linear Equation System-related material was students' understanding of understanding story problems, transforming into calculations that were still poorly understood by students, resulting in answers is wrong.

Student error in working on math problems become one of the instructions to detect student difficulties. Errors are a form of deviation from something real, a predetermined procedure, or departure from what is expected (Kurniasari, 2007). Detailed error analysis is needed so that errors and their causes can be further known so that student achievement in learning mathematics can be improved.

The error arises due to students' difficulties in learning mathematics. According to Newman, the types of an error made by students are 1) error due to carelessness or inaccuracy, carelessness caused by students not mastering concepts and mastering counting techniques. 2) Errors of process skills, in this error, students have learned the idea, but students are wrong in doing calculations or computing.

According to Singh (2010) and Jha (2012), students' errors in working on math problems consist of process errors, understanding problems, transformation, and reading problems. A process skills error is defined as an error produced by learners who are not able to: (1) comprehend the process/algorithm to remedy the case even though they can adjudge the formula correctly, or (2) run the procedure correctly also though it can determine the mathematical operations used successfully. This error is an error made by students in the calculation process. Students can choose what mathematical services to use, but they are not able to calculate them correctly. Types of process skills errors are also called P. types of errors. 3) Errors in understanding problems, students have not captured the information contained in the statement so students cannot process further from the problem.

An error of understanding (comprehension errors) is an error created by those who can not: 1) comprehend the meaning of a problem in general; 2) describe and elaborate what known from the challenge, or 3) explain and elaborate what asked from the problem. 4) Errors transform, students fail to change to the correct mathematical sentences.

An error of transformation is an that made by those not being able to: 1) decide the formula used to answer the problem; 2) decide the mathematical operation or series of services to remedy the problem in the problem properly; 3) identify operations or set of operations; 5) errors using notation, Students incorrectly use notation marks; 6) errors reading questions, students wrong in reading important words in statements

Reading errors is the error that students, who are not being able to: 1) recognize/read the symbols in the problem; 2) understand the meaning of the symbols in the problem, or 3) interpret the keywords contained in the problem, produced.

Departing from these problems, the authors try to analyze the error of students in working on the problem of Linear Equation Systems of Two Variables and provide alternative solutions to overcome these problems. This research can later be used to minimize these errors and improve achievement in learning the System of Two-Variable Linear Equation.

2. Method

This qualitative descriptive study involves 31 students of Indonesian junior high school of Central Java, Indonesia, as subjects of the study. To collect the data, documentation in the form of documents on the results of daily tests of student work was used. In addition, the interview technique was used as well; this technique was carried out to find out students' error and strengthen the results of the test analysis in solving Two-Variable Linear Equation System questions.

In this study, the validity of the data was carried out through triangular, comparing the results of interviews with the results of daily tests. Triangulation is a data validity checking technique that utilizes something else outside the data for checking or comparison purposes (Moleong, 2007). This study uses data analysis according to Miles and Hubberman (2002) with three stages, namely, reduction of data, presentation of data, and conclusion. Data reduction is in the form of interviews and test results conducted with students. Further, it is processed and presented in the retold text. Finally, conclusions are provided in order to reveal students' errors in solving questions on the material of the system of Two-Variable Linear Equation.

The questions given to the students are as follow:

Problem Description of Two Variables Equation System

1. *The price of 5 pieces of clothes and three fragments of t-shirts is Rp. 215,000.00. If the price of 1 part of clothing = x and one shirt is y. Then the mathematical model of the statement above is ...*
2. *The circumference of a rectangle is 72 cm. Its length is 4 cm more than its width. The area of the box is ...*
3. *The price of 10 notebooks and six pencils is Rp. 14,500.00. While the price of 6 laptops and five pencils is Rp. 9,750.00. The price to pay if you buy five notebooks and four pens are ...*
4. *Anita has Rp. 80,000.00. The money was exchanged for Rp 1.000 and Rp 500 banknotes. Finally, the notes obtained are 110 sheets. The amount of Rp 500 notes are …*

3. Results and Discussion

After analyzing data from the effects of daily tests and student interviews, it could be seen that there are still many students who make an error in solving the challenge of the system of Two-Variable Linear Equation. The test questions

consist of 4 items in the form of description, but in question number 1, there is no need to do data analysis because only one student made a mistake. There are 31 students whose types of error represent the types of error, namely errors understanding problems, transformation errors, and process skills errors. However, in this study, using six samples in conducting interviews. The following researchers describe the results of the research undertaken. Based on Newman's perspective, Table 1 reveals the types of students' errors.

Tabel 1: The error of Students Works Based on Newman Perspective

No	Name	Q 1	Q 2	Q 3	Q 4
1	Abel Amanda Ardelia	T	KP	KP	T
2	Aldi Wahyu S	T	MM	KP	MM
3	Annida Yumna K	T	TR	T	T
4	Budi Kasar P	T	T	TR	T
5	Cheisa WM	T	T	KP	T
6	Elsalia Dwi Hapsari	T	TR	KP	T
7	Angga	T	TR	KP	MM
8	Faiz Ardiar Putra	T	TR	KP	T
9	Farista Febriyani	T	T	KP	T
10	Fatihah A.S	T	T	T	T
11	Hamdah Nurrohilah	T	TR	T	T
12	Herlin Anggun Saputri	T	T	MM	T
13	Indah Handayani	T	T	T	T
14	Listya Ababil	T	TR	KP	T
15	Mahira Ria Nagata	T	T	KP	MM
16	Mardiana Sulistyowati	T	T	T	T
17	Meira Wahyu A.	T	T	T	T
18	Muhammad Gilang R	T	T	TR	MM
19	Muhammad Kurniawan	MM	T	MM	MM
20	Nazwa Albana	T	TR	T	TR
21	Novilla Priyanka	T	TR	KP	T
22	Nurul Azizah	T	T	T	T
23	Okky	T	TR	KP	TR
24	Putri Aprilia K	T	T	T	T
25	Raihan Alif Rohmadi	T	MM	MM	MM
26	Ramadhan	T	MM	KP	MM
27	Riyaldi Hasan S	T	MM	KP	MM
28	Shinta Isnandari	T	T	T	T
29	Usman M AR	T	TR	TR	T
30	Vigano Yan C.A	T	TR	KP	KP
31	Yusuf Bakhtiar	T	TR	KP	T

Description abbreviation
Q: Question
T: True
KP: Error in Process Skill
TR: Transformational Error
MM: Error in Understanding Problems

Table 1 can be concluded that students mostly made an error in answering questions 2, 3, and 4; thus, further investigation is needed. The following part of

this article will reveal errors made by students in answering queries of the Two-Variable Linear Equation System.

3.1 Error Understanding Problems

In this error, the problem is experienced as hardly understood by most students, so there is a mistake in working on it. Students will experience the next error, as Riyaldi did in problem number two.

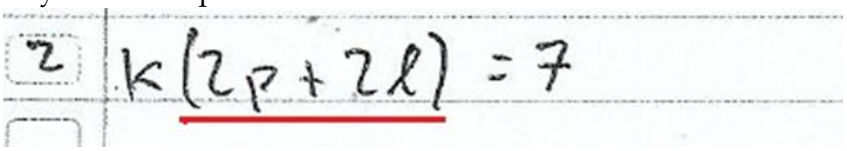

Figure 1: Error in Understanding Problems by Riyaldi

From Figure 1 above, a student named Riyaldi underwent a transformation of the problem, but the researcher considers Riyaldi to have an error in understanding the problem, the researcher concludes so because he sees the results of the following interview with Riyaldi.

Researcher	:	*What are you asking for number 2?*
Riyaldi	:	*I am looking for a rectangular area, sir*
Researcher	:	*What do you know about this question?*
Riyaldi	:	*Circular 72 and length four times more than its width*
Researcher	:	*How is the next step to solving that question?*
Riyaldi	:	*I cannot solve it sir*
Researcher	:	*What is the formula of the periphery of the rectangle?*
Riyaldi	:	*k = (2p + 2l)*
Researcher	:	*Why is it different from what is written?*
Riyaldi	:	*Because I am confused*
Researcher	:	*Study more*
Riyaldi	:	(nodding head)

Riyaldi, in this case, could not answer the questions because he could not understand the items given by the teacher to him, even though Riyaldi knew the formula circular of a rectangle. In writing, he transformed into the wrong form; it happened when he could not understand the problem, resulting in writing an improvised answer. The researcher concludes that misunderstanding the problem will result in further errors, both transformation errors and process skills errors.

Different from Riyaldi, Ramadhan experienced an error in understanding the problem. Thus he could not continue to answer the question. The following figure will give detail.

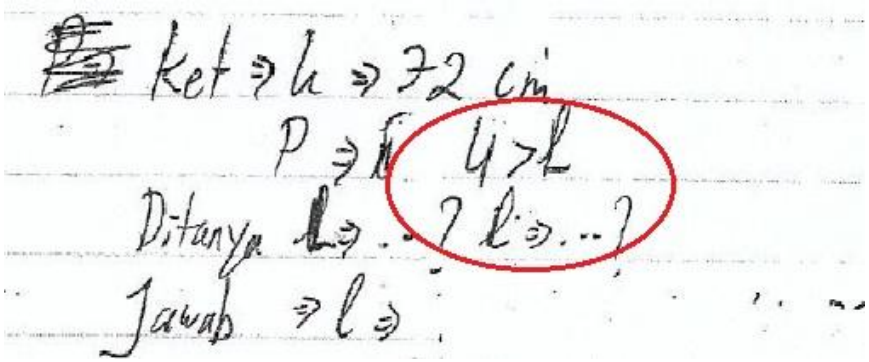

Figure 2: Error in Understanding Problems by Ramadhan

Researcher	:	*What does the question 2 ask about?*
Ramadhan	:	*It asks me to find the area of a rectangle with a known circumference*
Researcher	:	*What is known from the question?*
Ramadhan	:	*The circumference and length 4 are more than the width*
Researcher	:	*What is the formula for the perimeter and area of a rectangle?*
Ramadhan	:	*Circumference = 2 (p + l), Area = p x l*
Researcher	:	*What do you think your answer is?*
Ramadhan	:	*I cannot solve it, Sir. It is weird. I cannot apply them to the formula.*
Researcher	:	*Ok then. Next, you can study more.*
Ramadhan	:	Insyaallah, *Sir.*

Ramadan made a mistake in understanding the problem so that it could not resolve the answer. From the problem, there is the word "more than" but is interpreted partially, so that it is written ">" when what is meant is that the length of the rectangle is four times more than its width.

3.2 Transformation Error

In this study, many students understand the problem, but many are not biased working on the issues. The problem is in the form of changing to the type of mathematical model correctly. Examples of students' error in making a transformation error as in Figure 3.

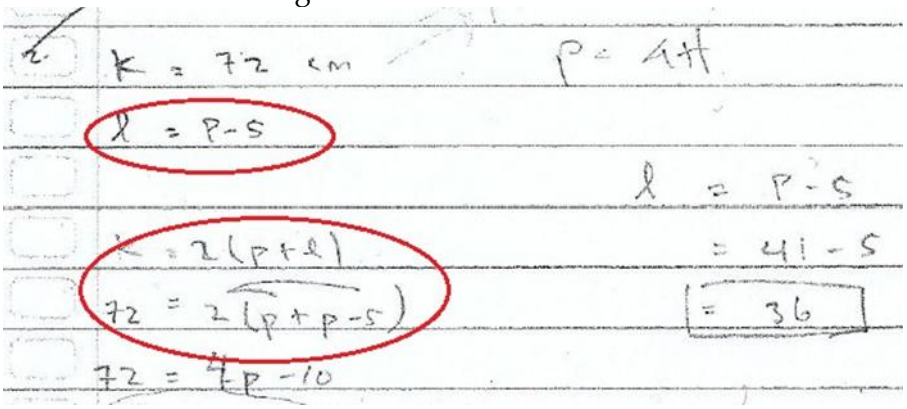

Figure 3: Transformational Error by Listya

In Figure 3, the length of the rectangle is 4 cm more than the width. The correct working step should be l = p - 4 or p = l + 4, but students experienced errors in transforming where changing the width was equal to the length minus 5. Next was a short interview with a student named Listya.

Researcher	:	*What is being asked in the second question?*
Listya	:	*It asks the length of rectangular*
Researcher	:	*What do you know about this question?*
Listya	:	*The circular and length of 4 cm are more than the width*
Researcher	:	*Do you know that the written formula you write Is it suitable for the question?*
Listya	:	*I don't know, sir, but I think if it's 4 cm in length So, the width will turn into l = p - 5, so I wrote it like that*
Researcher	:	*I see. Please learn more from your notes*
Listya	:	*Yes sir*

The interview results of this case show that students made errors in transforming, so students experienced errors in working.

Vigano Yanca experiences a transformation error where students answer questions instantly. The following pictures and interview results with Vigano Yanca are related to question number 2.

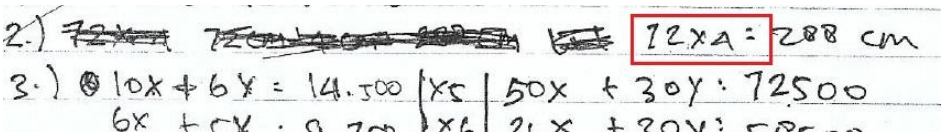

Figure 4: Transformational Error by Vigano Yanca

Researcher	:	*What does the question 2 ask about?*
Vigano Yanca	:	*It asks me to find the area of a rectangle, Sir.*
Researcher	:	*What is known from the question?*
Vigano Yanca	:	*72 cm in circumference and 4 cm in length more than the width*
Researcher	:	*If you already know the purpose of the step, what needs to be done?*
Vigano Yanca	:	*I don't know, sir, I just multiplied the numbers from the problem*
Researcher	:	*Learn more about the area and width of the rectangle.*
Vigano Yanca	:	*Yes, Sir.*

The interview results and the picture above shows that Vigano knew the purpose of the problem, but he was confused in transforming what he knew. So the student writes down the answer of what is known from the problem, which is the circumference of 72 cm and a length of 4 cm more than the width, there are two numbers, 72 cm, and 4 cm, and Vigano directly multiplies the two numbers.

3.3 Error Process Skills

Errors of process skills that are often done by students are wrong in calculating operations, either subtraction or division. Figure 3 below, is an error.

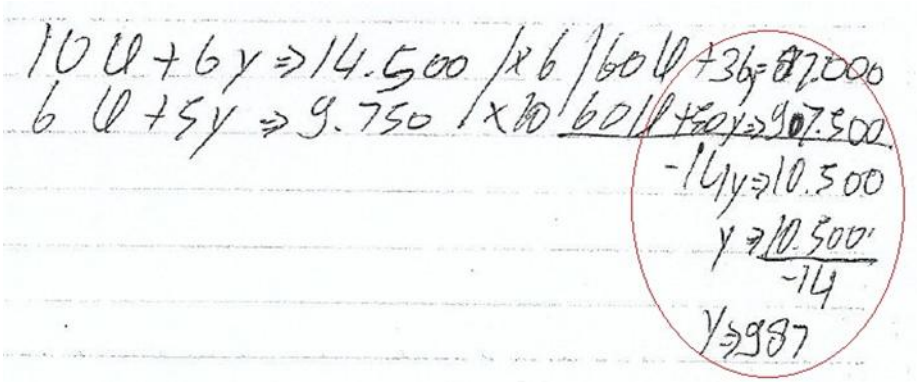

Figure 5: Process Skill Errors by Ramadhan

From Figure 5 above, the students are correct in transforming the problem into mathematical form, and it is just that the student is careless in the calculation process. If you look at the circle above, there are two errors, errors at the beginning will result in wrong results anyway. Below is the result of an interview between the researcher and a student named Ramadhan.

Researcher : *What is it asked in number 3?*
Ramadhan : *Counting the price of 5 books and four pencils*
Researcher : *What do you know about this question?*
Ramadhan : *The price of 10 books and six pencils is Rp. 14.500,00, while. The amount of 6 books and five pencils is Rp. 9.750,00*
Researcher : *How is the next step after you know what the question asks?*
Ramadhan : *book = x, and pencil = y then it is counted by using elimination*
Researcher : *Let's try to check the answer one ore*
Ramadhan : *Yeah, sir. I made a mistake. I finished this task in a rush yesterday. Thus, I did not test it again*
Researcher : *Tomorrow, I will complete the job with proper time management*

The above interview strengthens the opinion of researchers that Ramadan is experiencing a process skill error in question number 3. In addition to being wrong in writing minus numbers, Ramadan was also illegal in the division stage, and it should be 87000-97500 is -10500, not 10,500. This is negligence in giving the symbol minus. Apart from that, there are other errors in the division, 10500 / -14 should be the correct result is -750.

The next process error is also related to problem number 3, and this is a matter of a system of linear equations which requires careful work. In question number 3, in general, students use the method of substitution and elimination. Also, question number 3 is often used to solve problems in everyday life as well as compilations we buy things in traditional markets because, in the modern market, we already use e-notes with full unit price details. Below are the results of the work and interviews of students.

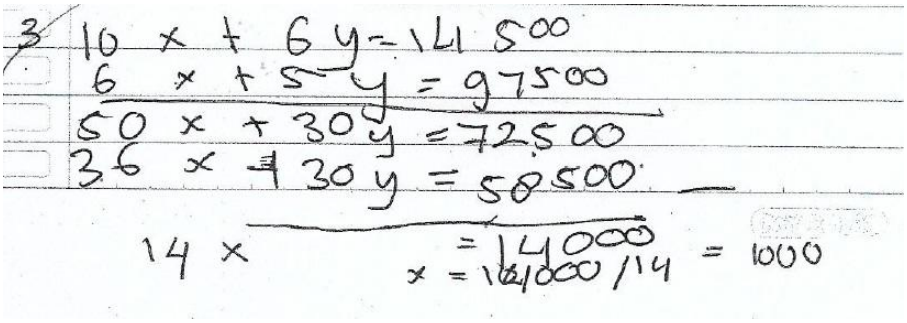

Figure 6: Process Skill Errors by Angga

In this case, students cannot continue working on the answers to the questions given. There are several reasons students cannot continue working on the issues, to find out these reasons, following the results of an interview with Angga related to question number 3.

Researcher	:	*What is it asked in number 3?*
Angga	:	*The overall price of 5 books and four pencils*
Researcher	:	*What is known about the problem?*
Angga	:	*Ten books and six pencils cost Rp. 14,500.00, 6 books for five pencils, the price is Rp. 9,750.00*
Researcher	:	*What is the next step after knowing the purpose of the problem?*
Angga	:	*For example, book x and pencil, sir, then I will do as taught by the teacher yesterday.*
Researcher	:	*Try to continue the work you are doing*
Angga	:	*I don't remember, sir, what I remembered from the teacher until then, the next way I forgot.*
Researcher	:	*Are you having trouble doing the calculations in the problem?*
Angga	:	*It is not so difficult, just confusing steps, sir.*
Researcher	:	*After this, look at the material written by the teacher.*
Angga	:	*Yes, Sir.*

In the above case, the student cannot continue the work because of forgetting the way taught by the teacher. This results in researchers confused in analyzing because it has two different possibilities between transformation errors or process skills. It could be that students' mistakes were made because they were confused about the formula being taught, so students wrote the wrong recipe so that it caused students to experience transformation errors. However, researchers more strongly conclude that the failure is due to a lack of student skills in the process of answering the problem or students are difficult in the calculation.

The results of the work of these students use the method of "substitution" in which students look for x value first. In this way, students should be able to work in the existing style of substitution, but the next step students do not use the same steps. If students use the same levels, namely substitution, maybe students can do it even if they do not use other methods such as elimination. This means it is not a transformation error but a lack of students in practicing

arithmetic and working on problems. Therefore, the researcher concludes that Angga has experienced a process skill error in answering the question.

From the results of the above research, it is necessary to have a detailed discussion related to the data obtained and analysis from researchers. Synchronization is needed in conducting this analysis. In this study, the researchers tried to apply binary opposition where if it was not right, then it was wrong. And using only two nominal values, namely 1 and 0, means that if the question was not answered, the researcher considered the student's work to be wrong and got a score of 0. The work of students who did not use mathematical steps was also regarded as wrong in this study. Error number 2 related to understanding problem number 4 or 12.90%; this includes the medium category. Error transformation of 12 or 38.71%, included enough classes. Process skill errors were 1 or 3.23%, including the medium type. Error number 3 related to understanding the problem several 3 or 9.68%, including the medium category. Error transformation of 2 or 6.45%, including the medium type. Process skill errors were 16 or 51.61%, including in the high class. Mistake question number 4 was related to understanding a problem of 8 or 25.80%, including enough categories — error transformation of 2 or 6.45%, and including the medium type. Process skill errors were 1 or 3.23%, including the medium class.

Based on the above discussion, then the researcher discusses the whole of this error. The tests and interviews results reveal that the factors that caused errors experienced by students in working on Two-Variable Linear Equation System questions are related to mistakes in understanding problems, transformation, and process skills.

These factors include understanding related to the meaning of the words contained in the problem. The language of questions was sometimes not easily understood by students; it is necessary to have a habit of reading questions to get used to the items that require particular understanding. A wrong understanding of the problem can also be caused by haste in working.

There was also an error of not being able to arrange the meaning of words into mathematical sentences or using formulas that were not by the context of the problem, this error, which researchers call the transformation error. Another factor that caused students false in answering the questions was that students were not carefully doing the work and forgot the next step that needed to be done. This often happened when students were too hasty in working because of insufficient time so that there were calculations that were not correct or stepped the work was missed. Some students forgot to work on these problems. In general, when students experienced errors in understanding problems, students would be wrong in writing formulas, calculations, and writing wrong final answers.

The results of this study are in line with research conducted by Anang (2017). Anang Research (2017) examines the students' mistakes in completing story questions on Pythagorean material at SMP Muhammadiyah 5 Surakarta. The

research was analyzed using Newman's theory. There were four errors found, (1) Errors in understanding the problems made by students by 41.33% included in the category of "enough."." (2) Errors in the stage of problem transformation made by students amounted to 54.67% included in the category of "sufficient."." (3) Errors in the process skills stage made by students by 61.33% included in the "high" category. (4) Error in the arena of writing the final answer made by students by 68.67% included in the class.

This study is in line with the research Fatimah (2017). They are examining junior high school students' errors in solving story problems on cube and block material. The subjects in this study were students of class VIII at SMP Negeri 1 Sambi Boyolali. The results of this study are 67.46% of transformation errors. Process skill error 61.44%. Error writing the final answer by 34.93% and errors in understanding by 25.30%.

This research is also not much different from Herlina's study (2014). Herlina (2014) examined the students' error in solving mathematical description questions in the form of stories. The theme of the discussion is the two-variable linear equation system. The subjects of this study were students of class VIII at SMP Negeri Ngemplak, Boyolali. The results of Herlina's research (2014) showed that the percentage of reading errors of 34.19% was low. Errors in the understanding of 38.71% are classified as small. Error transformation about 47.10% is classified as moderate. Process skill errors of 69.68% were classified as high, and failures of writing the final answer of 70.32% were classified as high.

There are two more similar studies, Priyanto (2014) and Sabani (2014). The two researchers also used Newman's theory in analyzing artistry problems. Priyanto's research entitled "Analysis of Student Errors in Solving Problem Questions in Mathematics Subjects of the Linear Equation System of Two Variables Based on the Category of Newman Errors in Class VIII A of SMP Negeri 10 Jember". The Sabani research is "Error Analysis in Resolving the Problem of Linear Class XI Second Semester Students in MAN Gandekan, Bantul, Yogyakarta." Priyanto's research results (2014) concluded that students made several errors in working on Mathematics problems. The errors are (1) error reading about 43%; this error is an error writing keywords and can not illustrate the image correctly. (2) Error understanding of questions by 46%, by not writing what is known and what is asked. (3) Error transformation about 49% in the form of an error in using the formula. (4) Process skill errors by 55%, in the way of errors in calculations. And (5) writing errors of the final answer by 61%, in the form of writing errors in the conclusion of questions. The results of Sabani's research (2014) show that many students make an error in solving linear program problems. The level of errors made based on the most number found is the transformation error, calculation error, error inferring, and understanding errors.

There are several key differences between the above research and this research. One, this study focuses more on analyzing students' answer errors in working on SPLDV questions. Second, analysis to find out students' errors is not only

based on the answer sheets written by students but also is obtained from the results of interviews with students. Three, this research is oriented to the evaluation of learning; teachers can improve the way of teaching. Also, the teacher can detect students who do not understand the material being taught. So, this research is not just looking for students' error in working on problems, but to improve the learning process.

4. Conclusion

After analyzing the effects of examinations and student interviews described above, the researcher concludes the forms of student errors in working on mathematical problems namely, (1) error of problem comprehending, when understanding the problem by students was misunderstanding the question in the meaning of students could not interpret the language of the problem given. Students tended to explain their understanding or turn problems into their writing. Also, some students did not understand the Two-Variable Linear Equation System concept, thus that students could not proceed to the next step. (2) Errors in the transformation stage, students made an error in changing the information given into mathematical models. Students understood what was meant by the problem, but students could not pour into formulas that could solve the problem. Students tended not to know the method to be used; thus, most of them were false in answering the questions. (3) Process skill error, at this stage students, experienced a lot of carelessness so that it was wrong in the process, students were less thorough and in a hurry to answer questions. Calculation errors related to subtraction or division were made the most by students because of the problem students could not continue work, or students experience errors in the final answer.

References

Galindo, C., Sonnenschein, S., & Montoya-Ávila, A. (2019). Latina mothers' engagement in children's maths learning in the early school years: Conceptions of math and socialization practices. *Early Childhood Research Quarterly*, 47, 271-283. https://doi.org/10.1016/j.ecresq.2018.11.007.

Goldin-Meadow, S., Shield, A., Lenzen, D., Herzig, M., & Padden, C. (2012). The gestures ASL signers use tell us when they are ready to learn math. *Cognition, 123*(3), 448-453. https://doi.org/10.1016/j.cognition.2012.02.006.

Hornburg, C. B., Schmitt, S. A., & Purpura, D. J. (2018). Relations between preschoolers' mathematical language understanding and specific numeracy skills. *Journal of experimental child psychology*, 176, 84-100. https://doi.org/10.1016/j.jecp.2018.07.005.

Huberman, M., & Miles, M. B. (2002). The qualitative researcher's companion. Sage.

Jha, S. K. (2012). Mathematics Performance of Primary School Students in Assam (India): An Analysis Using Newman Procedure. *International Journal of Computer Applications Engineering Sciences, 2*(1), 17-21.

Koponen, T., Aunola, K., & Nurmi, J. E. (2019). Verbal counting skill predicts later math performance and difficulties in middle school. *Contemporary Educational Psychology*, 59, 101803. https://doi.org/10.1016/j.cedpsych.2019.101803.

Kurniasari, Ika. (2007). Error Analysis of Class VIII Students of SMP Negeri 16 Surabaya in Solving Problems of Two-Variable Nonlinear Equation Systems. *Thesis*. Surabaya: Unisa.

Liu, J., Li, J., Peng, W., Feng, M., & Luo, Y. (2019). EEG correlates of math anxiety during arithmetic problem solving: Implication for attention deficits. *Neuroscience letters*, 703, 191-197. https://doi.org/10.1016/j.neulet.2019.03.047.

Maher, C. A., Sigley, R., Sullivan, P., & Wilkinson, L. C. (2018). An international perspective on knowledge in teaching mathematics. *The Journal of Mathematical Behavior,* 51, 71-79. https://doi.org/10.1016/j.jmathb.2018.05.002.

Moleong, L. J. (2007). *Metodologi Penelitian Kualitatif* [Qualitative Research Methodology]. Bandung: Rosdakarya.

Ng, J., Lee, K., & Khng, K. H. (2017). Irrelevant information in math problems need not be inhibited: Students might need to spot them. *Learning and Individual Differences*, 60, 46-55. https://doi.org/10.1016/j.lindif.2017.09.008.

Nordin, A. K., & Boistrup, L. B. (2018). A framework for identifying mathematical arguments as supported claims created in day-to-day classroom interactions. *The Journal of Mathematical Behavior,* 51, 15-27. https://doi.org/10.1016/j.jmathb.2018.06.005.

Prast, E. J., Van de Weijer-Bergsma, E., Miočević, M., Kroesbergen, E. H., & Van Luit, J. E. (2018). Relations between mathematics achievement and motivation in students of diverse achievement levels. *Contemporary Educational Psychology*, 55, 84-96. https://doi.org/10.1016/j.cedpsych.2018.08.002.

Ramirez, G., Chang, H., Maloney, E. A., Levine, S. C., & Beilock, S. L. (2016). On the relationship between math anxiety and math achievement in early elementary school: The role of problem-solving strategies. *Journal of experimental child psychology*, 141, 83-100. https://doi.org/10.1016/j.jecp.2015.07.014.

Silinskas, G., & Kikas, E. (2019). Math Homework: Parental Help and Children's Academic Outcomes. *Contemporary Educational Psychology*, 101784. https://doi.org/10.1016/j.cedpsych.2019.101784.

Singh, P., Rahman, A. A., & Sian Hoon, T. (2010). The Newman Procedure for Analyzing Primary Four Pupils Errors on Written Mathematical Task: A Malaysian Perspective. *Procedia on International Conference on Mathematics Education Research 2010* (ICMER 2010), *10*(8), 264-271.

Soedjadi, R. (2011). *To be good at mathematics Education.* Jakarta: Directorate of General Higher Education Ministry of National Education.

Swanson, H. L. (2016). Word problem solving, working memory, and severe math difficulties: Do cognitive strategies make a difference?. *Journal of Applied Research in Memory and Cognition*, *5*(4), 368-383. https://doi.org/10.1016/j.jarmac.2016.04.012.

Swanson, H. L., Kong, J. E., & Petcu, S. D. (2019). Individual differences in math problem solving and executive processing among emerging bilingual children. *Journal of experimental child psychology*, 187, 104653. https://doi.org/10.1016/j.jecp.2019.06.006.

Wasserman, N. H. (2018). Knowledge of nonlocal mathematics for teaching. *The Journal of Mathematical Behavior*, 49, 116-128. https://doi.org/10.1016/j.jmathb.2017.11.003.

Zhang, X., Hu, B. Y., Ren, L., & Fan, X. (2018). Sources of individual differences in young Chinese children's reading and mathematics skills: A longitudinal study. *Journal of school psychology*, 71, 122-137. https://doi.org/10.1016/j.jsp.2018.10.008.