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## STUDENTS' MATHEMATICAL PROBLEM-SOLVING PROCESS IN SOLVING STORY PROBLEMS ON SPLDV MATERIAL

### Abstrak

Kemampuan pemecahan masalah bagi siswa merupakan hal yang penting untuk dimiliki. Namun, kemampuan kenyataan di lapangan proses pemecahan masalah matematis masih belum optimal. Penelitian ini dilaksanakan untuk melihat karakteristik proses pemecahan masalah matematis siswa dalam memecahkan soal cerita khususnya pada materi SPLDV. Pendekatan yang digunakan adalah pendekatan kualitatif dengan metode pengumpulan data, reduksi data, dan penarikan kesimpulan. Sehingga penelitian ini tergolong jenis penelitian deskriptif kualitatif. Dari hasil penelitian yang dilakukan, diperoleh bahwa siswa dengan kemampuan matematis tinggi tidak dapat memeriksa Kembali jawaban yang telah diperoleh dengan baik. Sedangkan siswa dengan kemampuan matematis sedang juga tidak dapat memeriksa Kembali jawaban yang telah diperoleh dan proses solusi dengan baik dan benar. Selain itu, siswa dengan kemampuan matematis rendah tidak mampu menyelesaikan soal dengan langkah-langkah yang baik dan benar. Serta, siswa dengan kemampuan matematika rendah tidak mampu memeriksa kembali jawaban serta proses solusi yang telah dikerjakannya.

**Kata Kunci:** Pemecahan Masalah, Matematis, Soal Cerita, SPLDV

### Abstract

Problem-solving abilities for students are essential to have. However, the actual ability in the field of mathematical problem-solving processes still needs to be improved. This research was carried out to look at the characteristics of students' mathematical problem-solving processes in solving story problems, especially on SPLDV material. The approach used is a qualitative approach with methods of data collection, data reduction and conclusion. So, this research is classified as a qualitative descriptive research type. From the results of the research conducted, it was found that students with high mathematical abilities were unable to recheck the answers they had correctly obtained. Meanwhile, students with moderate mathematical abilities are also unable to recheck the answers they have obtained and process the solutions properly and correctly. Apart from that, students with low mathematical abilities are not able to solve problems with sound and correct steps. Also, students with low mathematical abilities need help to review the answers and solution processes they have worked on.

**Keywords:** Problem Solving, Mathematics, Story Problems, SPLDV

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## INTRODUCTION

Mathematics is a fundamental scientific discipline that serves as the foundation for the advancement of modern technology and plays a crucial role in other scientific fields. It is vital to possess a comprehensive understanding of mathematics, thus necessitating the inclusion of this subject in the curriculum for students beginning from the basic level (Netriawati, 2016; Ananda, 2018; Komang & Wayan, 2020; Rivai & Rahmat, 2023). The acquisition of mathematical knowledge is associated with the development of several cognitive capacities, including logical reasoning, analytical thinking, systematic problem-solving, critical thinking, and creative thinking (Marliani, 2015; Hakim & Windayana, 2016; Wicaksono et al., 2017; Kurniawati, 2018). Additionally, mathematics education also fosters collaborative skills among students.

The inclusion of problem-solving abilities within the mathematics curriculum is of utmost importance as it allows students to effectively utilize their existing knowledge and skills to tackle non-routine situations, hence facilitating experiential learning and problem-solving proficiency. The capacity to solve problems is a crucial component of self-directed learning and facilitates a departure from traditional instructional methods (Damanik & Fauzi, 2019; Roswanti et al., 2020; Setyawan et al., 2021). According to Silahuddin (2015), there is a positive correlation between students' level of independent learning and their effectiveness as learners.

The significance of problem-solving skills has been underscored by several academics (Sumartini, 2016; Cahyani & Setyawati, 2017; Nurhasanah & Luritawaty, 2021) who argue that problem-solving abilities are fundamental to the field of mathematics. The problem-solving proficiency of students is contingent upon the specific stage of their engagement in mathematical problem-solving tasks. Based on the works of Polya (Cahyani & Setyawati, 2017; Yuwono et al., 2018; Barus & Hakim, 2020), the stage of mathematical problem-solving has four key steps: (1) comprehension of the problem, (2) formulation of a solution strategy, (3) execution of the devised plan, and (4) reflection on the process and outcomes. The purpose of this initiative is to enhance students' proficiency in solving mathematical issues, specifically in executing methods to solve problems efficiently and accurately (Rofiqoh et al., 2016; Dwina et al., 2020; Syahputra et al., 2022). According to Polya, the problem-solving stage is also widely used in mathematics curricula around the world and is a precise problem-solving stage (Kurniawati et al., 2019; Salahuddin & Ramdani, 2021; Syahputra et al., 2022).

Questions about problem-solving abilities are usually found in story problems. The story questions are based on problems in everyday life. To solve story problems, you need to understand the steps required and practice using your reasoning (Amir, 2015; Sulistyaningsih & Rakhmawati, 2017; Agnesti & Amelia, 2020). However, there are still many students who need help solving mathematical problems in word problems (Novferna, 2016; Dila & Zanthly, 2020; Taufiq & Basuki, 2022).

The primary competency in the SPLDV Class VIII KTSP subject is creating and solving mathematical models of problems related to systems of linear equations in two variables. Many story questions are presented on this subject. Students are asked to use their mathematical reasoning skills to be able to solve mathematical problems in story problems.

From the results of observations by researchers at SMP Negeri 4 Tombariri, it was found that students' mathematical problem-solving abilities were different. The researcher teaches mathematics in class VIII and teaches SPLDV subject matter. The researcher gave an example of a story problem and then followed it up by giving a question that was the same as the example. The result is that students are almost able to do well. However, when given questions that are different from the example, differences begin to appear. There are students who can do it, and there are many who need help to do the story problems. From this phenomenon, researchers found that students' mathematical problem-solving abilities were different; some were low, medium, and high. For this reason, researchers are interested in describing the mathematical problem-solving process of students with high, medium, and low ability in solving mathematical problems in SPLDV story problems.

## METHOD

The approach taken in this research is qualitative, namely, research that uses qualitative data and then describes the data to produce a clear and detailed picture of the student's mathematical problem-solving process in solving story problems on SPLDV material. Meanwhile, the type of research is

descriptive qualitative.

The variable of this research is students' mathematical problem-solving abilities in SPLDV story problems. The research subjects in this study were 3 class VIII students at SMP Negeri 4 Tombariri in the even semester of the 2022/2023 academic year who were selected based on their level of mathematical ability, namely high, medium, and low mathematics ability. They were selecting research subjects by looking at the teacher's considerations. This is done because teachers know more about students' mathematical abilities, attitudes, and verbal communication skills so that when they are interviewed, students can express their opinions.

There are two types of instruments in this research, namely, main instruments and auxiliary instruments. The main instrument is the researcher himself, and the auxiliary instruments are mathematical problem-solving skills, interviews, and documentation. The questions that will be given are tested for the validity of the question items. The validity that will be used in the test instrument is content validity, with two lecturers and one teacher asked to check each item on the measurement instrument.

The data analysis technique carried out in the research uses a flow model, which includes activities for reducing data, presenting data, and drawing conclusions. The data obtained from this research are the results of tests on students' mathematical solving abilities in solving story problems on SPLDV material and from the results of interviews between researchers and interview subjects.

Research subjects will work on mathematical problem-solving ability test questions. This test is used to determine the process of solving mathematical problems by students with high, medium, and low mathematical abilities in solving story problems on SPLDV material. After the subject has worked on the mathematical problem-solving test questions, the researcher will then carry out an analysis of the results of the mathematical reasoning test.

## RESULT AND DISCUSSION

### 1. Research Data

This research data was taken from 3 class VIII students at SMP Negeri 4 Tombariri. The three students were divided into 1 student with high mathematics ability, 1 student with moderate mathematics ability, and one student with low mathematics ability. This selection was carried out purposively by the mathematics teacher at SMP Negeri 4 Tombariri, Mrs. Temi B. Purwandari S.Pd. Then, the mathematical problem-solving abilities in the SPLDV material will be analyzed. The author considers this to be valid because teachers are more familiar with the mathematical abilities of their students.

### 2. Development of Research Instruments

The instrument used in this research is a written test of mathematical problem-solving abilities, which aims to measure students' mathematical problem-solving abilities in the material Systems of Linear Equations in Two Variables. The questions in this instrument are created based on indicators in the Two Variable Linear Equation System (KTSP) material, namely: 1) getting to know SPLDV in various forms and variables, 2) determining the roots of SPLDV using the elimination and substitution method, 3) creating mathematical models of everyday problems. Days related to SPLDV, and 4) completing mathematical models of problems related to SPLDV and their interpretation. The mathematical problem-solving ability test consists of 5 questions. Before being used, this question was validated first by two expert judgements consisting of 2 lecturers from the Mathematics Department at UNIMA and one mathematics teacher at SMP Negeri 4 Tombariri. Validation is directed at the quality of the questions, the suitability of the problem, and the language used.

### 3. Discussion of Research Results

#### a. Students with High Ability

Jawaban

(1) Dik. Jumlak Ke 2 bilangan 10  
 Selesai 11 10  
 Dit. Nilai Ke 2 bilangan

Pemflesaian:

mis bil. 1 =  $x$   
 bil. 2 =  $y$

$$\begin{aligned} x + y &= 40 \quad \dots (i) \\ x - y &= 10 \quad \dots (ii) \end{aligned}$$

$$\begin{aligned} x + y &= 40 \\ x - y &= 10 \\ \hline 2y &= 30 = 15 \end{aligned}$$

Sub. nilai  $y = 15$  ke persamaan I

$$\begin{aligned} x + y &= 40 \\ x + 15 &= 40 \\ x &= 40 - 15 \\ &= 25 \end{aligned}$$

Jadi bil. 1 = 15, dan bil. 2 = 25

Figure 1 Results of work of students with high mathematical abilities in number 1

Based on the findings derived from the analysis conducted on the students' work, as visually depicted in Figure 1, it can be inferred that the students possess a comprehension of the issues inherent in the posed questions. This phenomenon is evident in the responses provided by students who are capable of accurately identifying and addressing all the components that are specified and inquired about within the given question. The subsequent phase involves formulating a plan to address the issue at hand. The process of estimating the answer and solution can be facilitated by assigning the variable  $x$  to the first number and the variable  $y$  to the second number. Subsequently, pupils possess the capability to transform the given pieces of a problem into a mathematical model. Following the strategic formulation of a problem-solving approach, the subsequent phase entails the execution and implementation of said plan. At this juncture, children possess the ability to engage in problem-solving activities. Students utilize a comprehensive range of established elements. The equations  $x+y=40$  and  $x-y=10$  is eliminated by the students, resulting in the derived equation  $y=15$ . Subsequently, the process of determining the value of  $x$  is carried out by replacing the assigned value of  $y$ , which is equal to 15, into the initial equation. The collected data indicate that the value of  $x$  is 25 and the value of  $y$  is 15. The concluding phase entails the process of review. At this juncture, the student demonstrates the act of verifying his work, formulating deductions, and subsequently providing the solution to the initial inquiry through the written statement, "Thus, the value of number 1 is 15, while number 2 is determined to be 25."

The results of interviews with students are as follows:

- Q : In your opinion, this question is easy, medium, or difficult?  
 S : Easy ma'am.  
 P : Oh. Why is it easy?  
 S : Because it has been taught before.  
 Q : Have all the known elements been used?  
 S : Yes, ma'am.  
 P : Here, for example, number 1 is the same as  $x$ , and number 2 is the same as  $y$ . Does the number 1 have to be  $x$  and not interchangeable?  
 S : Yes, ma'am, this is just an example.  
 Q : What method did you use to solve this problem?  
 S : Elimination and substitution  
 Q : Can you explain?  
 S : So, ma'am, subtract the second equation so that you get a value of  $y$  equal to 15. After that, enter the  $y$  obtained into the second equation. Get  $x$ ).

- Q : So, are you sure this answer is correct? Have you rechecked?  
 S : That is all, ma'am.  
 Q : How do you check whether the results obtained are correct?  
 S : Just add  $x+y=40$ . If it is true, it means it is true. If it is wrong, it is wrong.  
 Q : In your opinion, is there another way to solve this problem?  
 S : There seems to be.  
 Q : What?  
 S : Maybe graphics

b. For Students with Medium Mathematics Ability

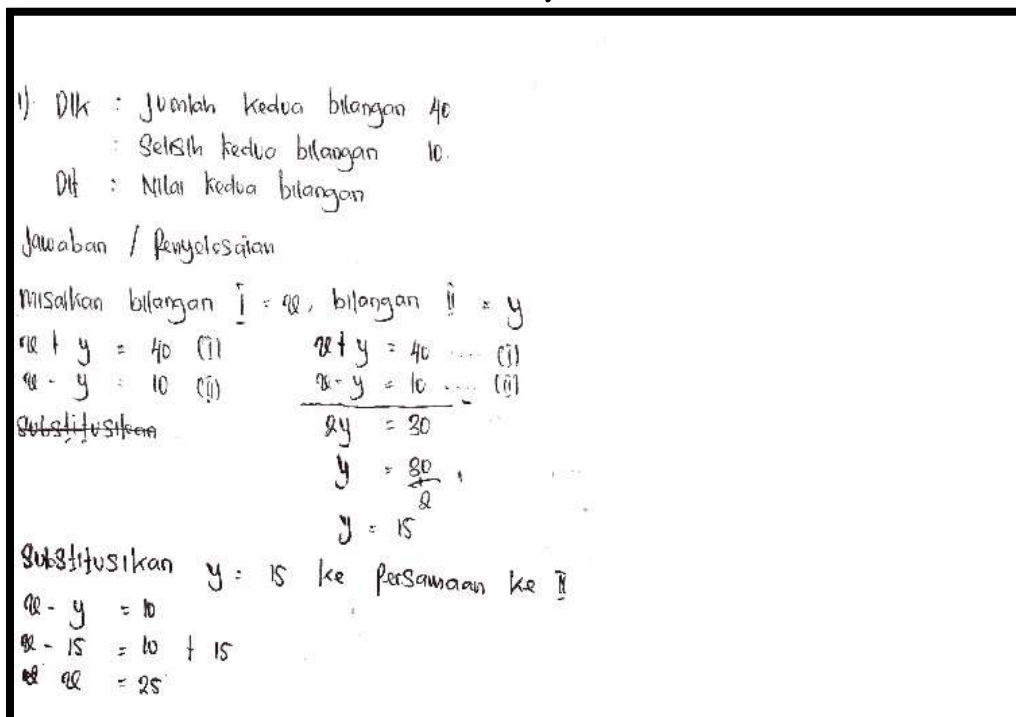


Figure 2. Results of students with moderate mathematical abilities on question number 1

In Figure 2, it is evident that pupils possess the ability to comprehend the situation at hand. This phenomenon is observable as students tend to include all the aspects that are recognized and explicitly mentioned in the questions. The subsequent phase entails the formulation of a strategic plan to address the issue at hand. The image depicts students engaging in problem-solving by employing a strategy wherein they assign the variable  $x$  to represent the first number and the variable  $y$  to represent the second number. Subsequently, pupils can utilize and manipulate established elements to construct a mathematical model. This can be achieved by formulating the equations  $x+y=40$  and  $x-y=40$ . The subsequent phase involves the execution of the resolution procedure, which pertains to the process of problem-solving. At this level, the students proceed to eliminate the first and second equations, resulting in the determination of the value  $y=15$ . Next, the students proceed by substituting the value  $y=15$  into the second equation, resulting in the determination of  $x=25$ . The concluding phase entails the process of review. At this level, students refrain from providing the  $x$  and  $y$  values in response to the question, thus preventing any conclusive inferences.

The following are the results of interviews with students.

- Q : In your opinion, this question is easy, medium, or difficult?  
 S : Easy.  
 Q : Have you used everything you know to solve the problem?  
 S : Yes, ma'am.  
 Q : What is the relationship between the known data and what is being asked about?

- S : The question can be answered if we know what we know and ask.  
 P : Oh yeah. Then, what method did you use to solve the problem in this problem?  
 S : Elimination and substitution, ma'am.  
 Q : Can you explain what you wrote here?  
 S : I subtracted this, so I got y. Plug y into the second equation to get x.  
 Q : Why do you have to substitute y in the second equation? Can't you substitute in the first equation?  
 S : Yes, ma'am. Just select.  
 Q : In your opinion, the method used to solve this problem is correct?  
 S : Yes.  
 Q : How do you prove that this answer is correct?  
 S : Just match it, ma'am. If what I get is correct, that means  $x+y=40$ .  
 P : Yes, that is right. Have you rechecked this answer?  
 S : Yes.  
 Q : In your opinion, is there another way to solve this problem?  
 S : As far as I know, this is the only one, ma'am.

c. For Students with Low Mathematics Ability

1. Dik: Jumlah 2 bilangan adalah 40  
 Selisih kedua bilangan adalah 10

Dit: Nilai kedua bilangan.

Jawab:

$$\begin{aligned} x+y &= 40 \dots \text{Persamaan 1} \\ x-y &= 10 \dots \text{Persamaan 2} \end{aligned}$$

$$\begin{array}{r} x+y=40 \\ \underline{x-y=10} \phantom{-} \\ 2y=30 \\ y=\frac{30}{2} \\ y=15 \end{array} \Rightarrow \begin{array}{l} x-y=10 \\ x-15=10 \\ x=10+15 \\ x=25 \end{array}$$

Figure 3. Work Results of Students with Low Mathematics Ability

In Figure 3, students can comprehend the situation. The students compile a list of all the items within their knowledge and afterwards respond to a series of inquiries. The subsequent phase involves the formulation of problem-solving strategies. Currently, it is evident that pupils possess the ability to devise a solution by employing the two methodologies that will be employed in the process of problem-solving. In this scenario, students employ the elimination method followed by the substitution method. Following the initial planning phase, the subsequent step is the actual problem-solving process, which entails determining the appropriate course of action to address the situation at hand. In this scenario, kids possess the ability to accurately answer the questions. In the process of problem-solving, students employ all available data. Subsequently, by the process of removing the first equation and the second equation, the resulting value for y is determined to be 15. The value of y is inserted into the second equation, resulting in the solution  $x=25$ . The concluding phase entails the process of review. At this point, pupils refrain from formulating definitive conclusions.

The following are the results of interviews with students:

- Q : In your opinion, this question is difficult, medium, or easy?

- S : Easy ma'am.  
 Q : Have you used all the elements that are known and asked to solve the problem?  
 S : Yes, ma'am.  
 Q : In your opinion, what is the relationship between the elements that are known and asked about in the question?  
 S : ... (Silence)  
 Q : Then, what method did you use to solve this problem?  
 S : Elimination ma'am.  
 Q : Is that all? Isn't there another event to complete it?  
 S : Ehmm. Yes, I think that's all, ma'am.  
 Q : Are you sure about that answer? Have you checked again?  
 S : Yes, ma'am. Already.

## CONCLUSION

Based on the results of the analysis and discussion from the previous chapter, the following research conclusions can be stated:

### 1. Mathematical Solving Ability in Students with High Mathematical Ability

Students with high mathematical abilities can write and use all known elements to solve the problems in the questions. Students with high mathematical abilities can explain the relationship between known elements and those asked about. Students with high mathematical abilities can determine and apply the methods that must be used to solve the problems in the questions. Students with high mathematical abilities can solve problems with correct and appropriate steps. Students with high mathematical abilities need help to recheck the answers they have appropriately obtained.

### 2. Mathematical Problem-Solving Ability in Students with Medium Mathematical Ability

Student with moderate mathematical abilities can write and use all the elements known to the problem in finding solutions to the problems in the problem. Students with moderate mathematical abilities can explain the relationship between the known elements and those asked about. Students with moderate mathematical abilities can determine and apply the methods that must be used to solve the problems in the questions. Students with moderate mathematical abilities need help to solve problems with correct and appropriate steps. Students with moderate mathematical abilities need help to recheck the answers they have obtained and process solutions properly and correctly.

### 3. Mathematical Problem-Solving Ability in Students with Low Mathematical Ability

Students with low mathematical abilities can write and use all the known elements of the problem to solve it. Students with low mathematical abilities need help explaining the relationship between the known elements and those asked about. Students with low mathematical abilities can determine the methods that should be used to solve problems but need help to apply these methods correctly. Students with low mathematical abilities need help to solve problems with reasonable and correct steps. Students with low mathematical abilities need help to review the answers and solution processes they have worked on.

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