Problem solving-based learning on systems of linear equation in three variables at SMA Srijaya Negara Palembang

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Problem Solving-Based Learning on Systems of Linear Equation in Three Variables at SMA Srijaya Negara Palembang

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This research is a descriptive qualitative study that aims to determine the ability of students to understand the system of three-variable linear equations problem through problem-solving instruction. The subjects chosen in this study were 6 students from SMA Srijaya Negara Palembang, consisted of 2 students with higher ability, 2 students with moderate ability, and 2 students with lower ability. The data was collected through test results and interviews then analysed descriptively. The results indicated that students were able to understand the problem and evaluate the obtained result. While students with lower ability struggled in using the substitution rule, therefore, could not establish the plan and solv the problem completely and correctly.

Key words: *SPLTV, problem-solving.*

Introduction

As stated in the National Education Standards Agency (BSNP, 2006) the learning objectives of mathematics are students who have problem-solving skills that include the ability to understand problems, design mathematical models, solve models, interpret solutions obtained. According to (Pehkonen, 1997) the importance of problem-solving skills is to be able to develop cognitive skills, enhance creativity, is part of the mathematical application process, and can motivate students to learn mathematics. (Branca, 1980) also argues that problem-solving is a fundamental ability that must be mastered by students because it is considered as the heart of mathematics. The results of the study (Leung, 2016) also show that problem-solving has an essential role in mathematics learning. This is in accordance with the statement (Krulik and Rudnik, 1995) that problem-solving is a process of thinking. So it can

be concluded that problem-solving is a core activity in the classroom in learning mathematics at all levels of education (Silver, Clark, Ghousseini, Charalambous, & T. Sealy, 2007).

According to (Heri Setiawan & Harta, 2014) the primary purpose of learning mathematics is to develop the ability to solve complex mathematical problems. Development of problem-solving abilities is significant to solve problems in everyday life (Educational et al., 2012). The ability to solve problems is the ability needed as a provision for learning in everyday life (Surur, M. & Handarini, 2016). Students ability to solve problems can be known when they are faced with various problems (Surur, M. & Handarini, 2016). Each student certainly has different abilities and abilities possessed by students certainly play an essential role in solving problems. Students who have high skills will be more successful in reaching achievements and overcoming problems in their daily lives (Surur, M. & Handarini, 2016).

Problem-solving is a cognitive activity that allows students to connect concepts in building understanding (Educational et al., 2012). According to (Saad & Ghani, 2008), problem solving is a planned process that needs to be carried out in order to obtain specific solutions to a problem that may not be completed immediately. According to (Xueui, 2003) problem-solving learning is more important given than giving routine problems with definite settlement procedures. Questions-problem-solving problems (not routine) are certainly different from routine questions that tend to be easier. As said (Hartatiana & Darmawijoyo, 2011.) in solving non-routine questions, more in-depth thinking is needed to understand the purpose of the problem given. For this reason, students must practice frequently and have a lot of experience working on problem-solving problems in order to solve non-routine problems. However, some research results show that students'problem-solving abilities are still low. One of the studies conducted by (Uly, 2016) found a variety of difficulties students get in solving problems-solving problems (Redish, 205) also argues that students have difficulty in solving more complex problems.

Problem-solving learning can be applied to achieve the mathematics learning goals listed in the BSNP and solve these problems. Four steps must be done to solve the problem-solving problem that includes, the ability to understand the problem, the ability to plan the settlement, the ability to carry out the solution and the ability to look back (G. Polya, 2004). (Carson, 2006) argues that knowing or understanding the meaning of a problem is more important than solving it. Which means that if students have been able to understand the problem, of course, students will be able to solve problems to the next stage.

Problem-solving programs should be developed in more natural situations and provide problems related to everyday life so that they can attract students' interest and attention. (Maksum, Maliki, & Hidayat, 2017) also states that problem-solving activities involve excellent problem-solving skills to find the right solution to a problem, so teaching students

to develop problem-solving skills is a must. According to (Ayu Yarmayani, 2016) problem-solving ability is the ability of students to find solutions that aim to solve problems. So, the problem-solving process can occur when students need to resolve a situation where they do not know a series of specific actions that must be done to solve a problem (Newell & Simon, 1972).

Method

This research is a qualitative descriptive study. The focus of this study is the ability of students in problem-solving learning in material systems of three-variable linear equations in high school. The subject of this study was the tenth-grade students at the SMA Srijaya Negara Palembang who were selected based on several criteria. Data collection techniques used included tests and interviews. After retrieving data obtained from student tests results and giving coding according to learning steps of problem-solving, the researcher proceeded to analyze the students'' answers according to the steps in problem-solving learning and present them in narrative form. The researcher also conducts the interview stage in order to convince the truth of the answers the subject has done.

Discussion

Subjects in this study were divided into 3 categories, namely, subjects who have high abilities, subjects who have moderate abilities and subjects who have low ability to solve problem-solving problems.

Table 1: List of Research Subject Names

No	Subject Initials	Category
1.	AA	High
2.	GA	High
3.	IM	Moderate
4.	AAQZ	Moderate
5.	MOA	Low
6.	AH	Low

The learning process is carried out based on the lesson plan that has been developed by researchers and has been validated by Sriwijaya University lecturers. The test questions provided contain daily life issues in SPLTV material. These problems can be solved using the stages of problem-solving. Furthermore, the learning steps of problem-solving are seen based on the results of the answer sheets that have been done by students by analysing the completion steps following problem-solving learning. The following is the conclusion of the

researcher based on the analysis of students' abilities in problem-solving learning presented in table 2.

Table 2: The steps for Problem Solving learning that appear in the student's answer

Question Number	Subject	Indicator that appears			
		A	B	C	D
1	AA	√	√	√	√
	GA	√	√	√	√
	IM	√	√	X	√
	AAQZ	√	√	√	√
	MOA	√	X	X	√
	AH	√	X	X	√
2	AA	√	√	√	√
	GA	√	√	√	√
	IM	√	√	X	√
	AAQZ	√	√	√	√
	MOA	√	X	X	√
	AH	√	X	X	√

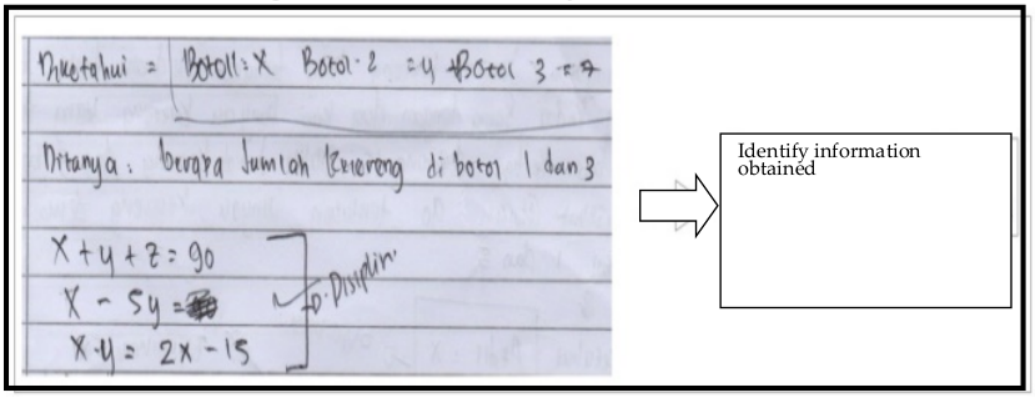
Explanation:

√: Indicator that appears
X: Indicator does not appear
A: Understanding the problem
B: Planning a solution
C: Resolve the problem
D: Re-check

The table above is a learning step to solve problems that arise when students solve problems that are given. As seen in the table, students who have a high ability can solve problems using problem-solving learning steps. While students who have a low ability to difficulty in making a plan for solving and solving problems. The following is the complete results of the analysis of data based on the test results, which are also supported by the results of interviews with students who have low abilities:

MOA Subject
Understanding the problem
(identify information obtained)

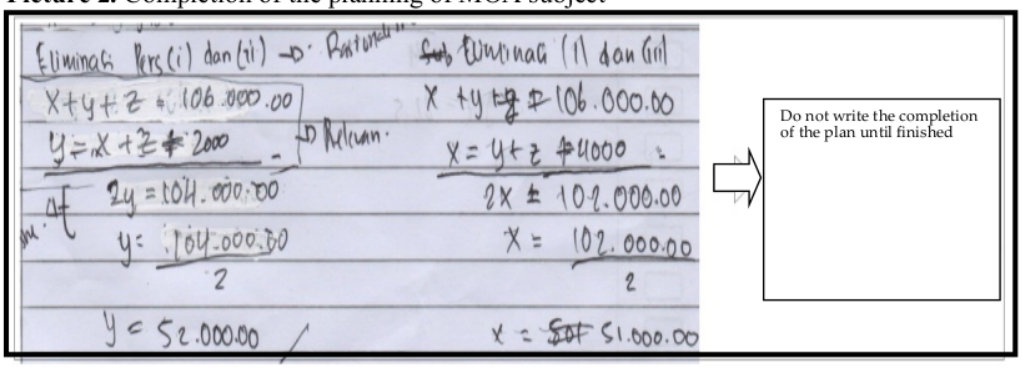
Picture 1. Understanding the Problem of MOA Subject



The MOA subject can identify the information obtained from the question into a simpler form of mathematics. When conducting an interview, the researcher gives back the same question and asks the subject to recreate the information obtained. The following are the results of the interviews:

N: What information is contained in the question?
S: What is known is that Afdil Bram and Rido collected money to buy a new bicycle, the sum of their money was 106,000. and looking for a lot of their own money.

Completion of the planning
(do not write the completion of the plan until finished)
Picture 2. Completion of the planning of MOA subject

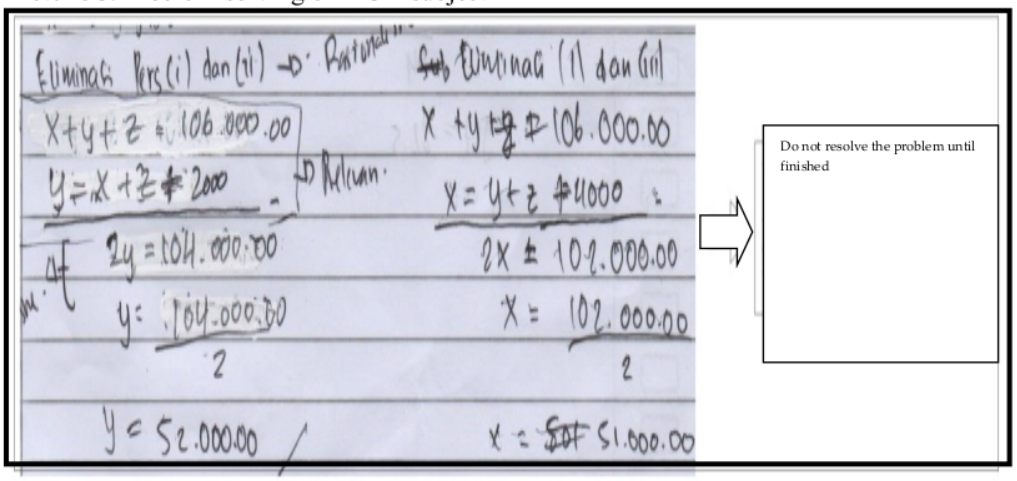


As seen in the picture, the subject did not complete the plan that was used thoroughly. At the time of the interview, the subject also explained that the subject knew the rules that were used but did not need to understand, resolved using substitution rules because they were confused in subsidising a value into coordination. The following are the results of interviews conducted:

N: What concepts or principles are used to solve the problem?
S: Elimination of Equation 1.

Problem Solving
(don't resolve the problem until finished)

Picture 3. Problem-solving of MOA subject

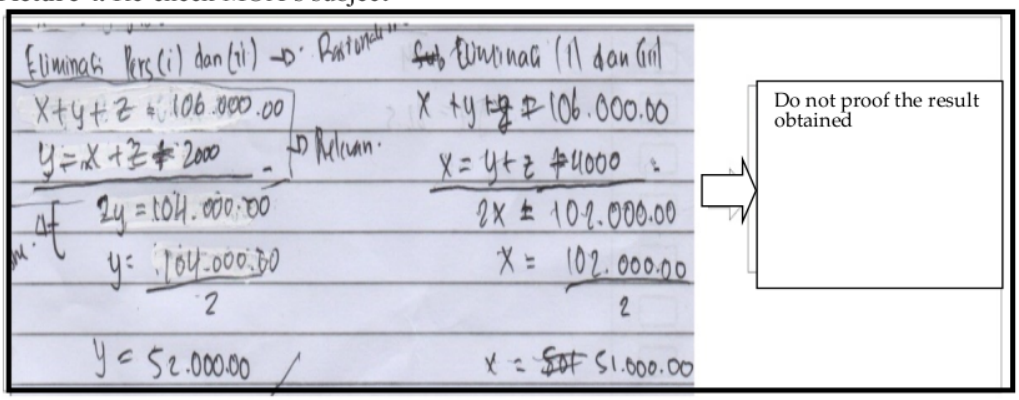


As seen in the picture, the subject was not able to solve the questions that were given thoroughly and correctly. At the time of the interview, the subject said that he was not too understanding in solving the problem. The following are the results of the interviews:

N: Do you understand the questions given?
S: If you understand, it's just the way it is. Confused, for example, you already got one result, you don't know what to do again

Re-check
(don't proof the result obtained)

Picture 4. Re-check MOA's subject

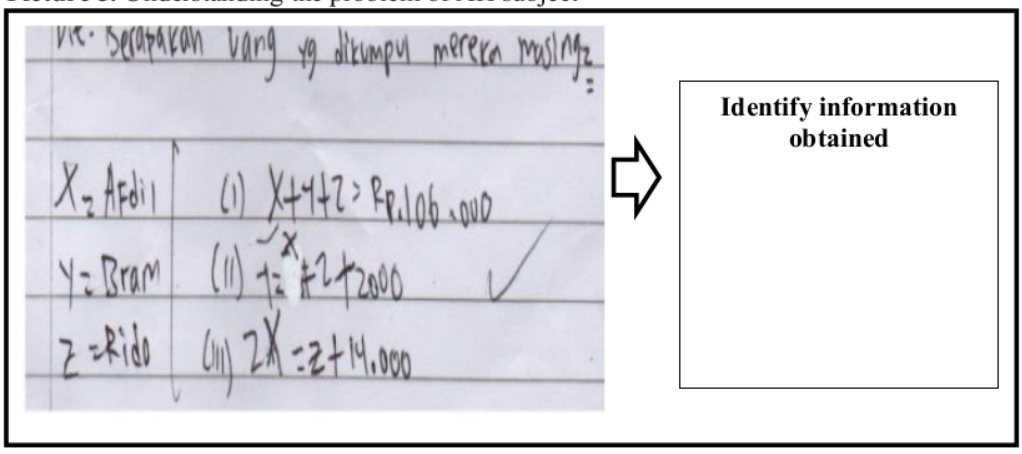


The MOA subject was unable to solve the problem completely, so the subject did not write a proof of the results of the answers obtained. However, when interviewed the subject knows how to do the answers that have been obtained as follows:

N: How do you know the answers you have done right or wrong?
S: On the test, proof

AH Subject
Understanding the problem

Picture 5. Understanding the problem of AH subject

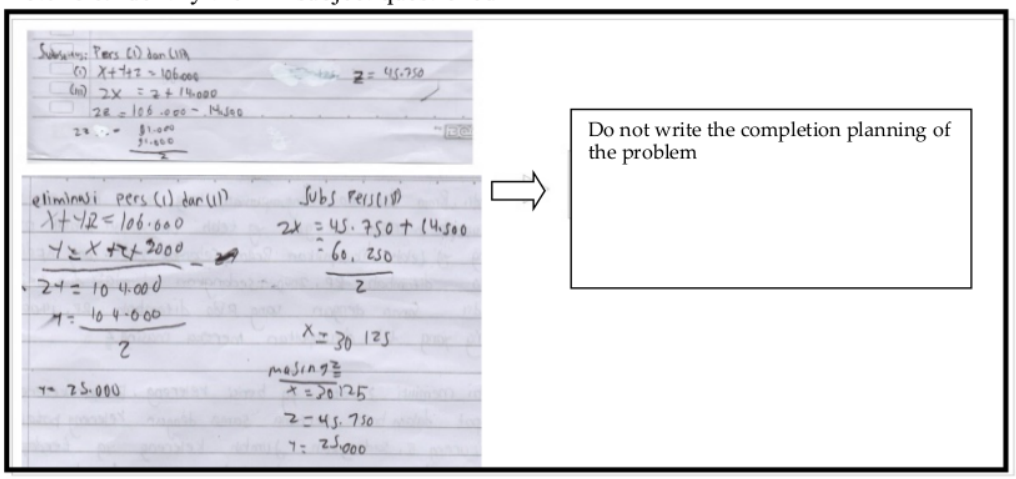


The AH subject is able to identify the information obtained from the problem. As seen in the picture, the AH subject is able to translate information that is known from the problem into a simple sentence using the symbols x, y, and z. When conducting an interview, the researcher gives back the same question and asks the subject to recreate the elements that are known from the problem. The appearance of these indicators is corroborated by the results of interviews that are conducted to the subject below:

N: What information is contained in the question?
S: Afdil, Bram, and Rido collect money to buy a new bicycle. The amount of money the three of them collected was 106,000, then Afdil, Bram, and Rido were made into x, y, and z. And look for how much money they have collected.

Completion of the planning
(don't write the completion planning of the problem)

Picture 6. Identify the AH subject questioned

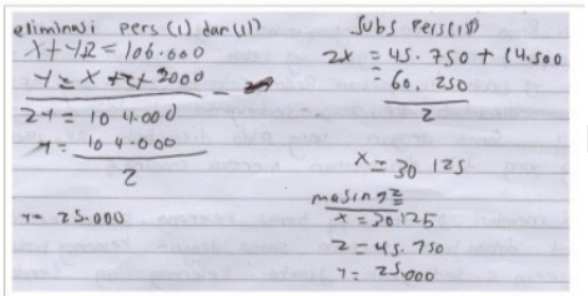


In problem-solving, the AH subject is unable to write the completion plan completely and correctly. At the time of the interview, the subject knows the rules used to solve the problem, but the subject is still confused about the completion steps that will be done. The subject only knows the rules that are used but does not know the steps of the process. The following are the results of interviews conducted:

N: The concept or principle used to solve the problem?
S: Substitution and elimination

Problem-Solving

Picture 7. Problem-solving of AH subject

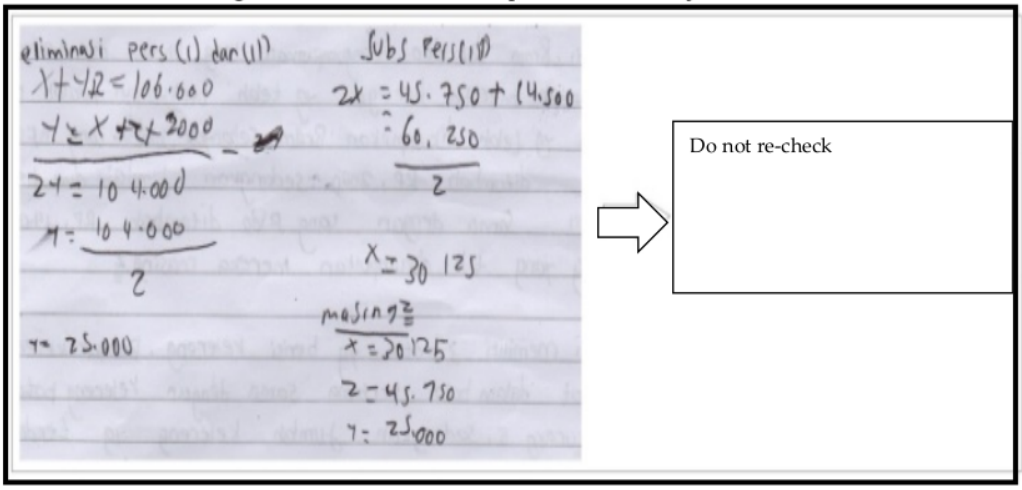


As seen in the picture, the AH subject was unable to solve the problem until it was finished completely. The results of the interviews conducted also did not support the subject being able to solve the problem regularly because the subject was not able to mention the steps to complete completion. The results of the interviews conducted were:

N: Yesterday how did the steps work?
S : Equations 1 and 3 are eliminated, get the value of z, after that, I don't know Sir, confused.

Re-check
(don't re-check)

Picture 8. Connecting the mathematical concept to the AH subject



The AH subject was unable to solve the problem completely so that the subject did not prove the answer he had received. However, when interviewed the subject knows the method used to test the answers that have been done as follows:

N: How do you know the answers you have done are correct?
S: First practised or proven.

Based on the results of the analysis of the researchers' student test results as above, the learning step that the domain student is able to do is understand the problem and check again. Understanding problems involve students identifying information obtained from questions and translating into a simpler mathematical model using symbols. This is also supported by (Dollah, 2005) that students can identify known and asked elements into a more straightforward form because in the learning process the teacher has invited students to identify known elements and asked questions when completing examples question. (Dollah, 2005) also means that identifying elements that are known to occur implicitly and implicitly during the learning process. This is following the opinions expressed (Robert, 2011) that the important role of repetition and the exercises taught in the learning process have a high probability of memory being stored in long-term memory.

The stage of checking again where students test the answers obtained by subsidizing the values obtained into known equations. During the learning process, researchers have familiarised students with proof of answers so students cause this dominant stage to appear in each student in solving problem-solving problems.

The stage that does not appear in some students is to plan solutions and solve problems. The step of planning to solve and solve problems where students make hypotheses about how to plan and solve problems based on what he found in the problem when understanding the problem and applying it to solve the problem (Carson,2006). Students who have high and moderate abilities do not have problems in planning the resolution of a problem regularly. As sad (Surur, M. & Handarini, 2016) that students' abilities play an important role in solving problems faced. However, subjects who have low ability are not able to plan the resolution of a problem regularly because the subject is not able to solve the problem completely. This is contrary to the theory put forward by (Carson, 2006) that if students have been able to understand the problem, of course, students will be able to solve the problem to the next stage. Based on the data obtained, students know the method used to solve the problem but students have difficulty applying the rules used because students do not understand the steps to use substitution rules and the subject is confused what steps to take after getting the value from one of the variables asked. In line with the results of the research conducted (Ibrahim, 2015) that students who have low ability are not able to use the substitution rules correctly. In solving problems, subjects who have low ability only know the methods used but cannot

hypothesize and apply it to solve problems. In line with the results of the research conducted (Ibrahim, 2015) shows that students who have low ability have difficulty in planning and implementing a settlement plan. (Sholekah, Anggreini, & Waluyo, 2017) also stated in his research that students who have the low ability to have difficulty in solving the problems given. This is what causes students who have the low ability to have difficulty in solving the problems given.

Conclusion

Based on the results of the research that has been carried out, the conclusions are as follows:

1. All students can understand the problem and check answers obtained because during the learning process the teacher has accustomed students to writing information that is known and asked about the questions
2. Students who have low abilities are not able to plan and solve problems because students have difficulty using the substitution rules to solve problems.

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