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by Ade Muharani

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High school students' modelling ability in creative problem-solving

Esterlina[1], Y Hartono[1*], C Hiltrimartin[1], and Indaryanti[1]

[1]Mathematics Education Department, Universitas Sriwijaya, Palembang, South Sumatra, Indonesia

*Corresponding author's email: y_hartono@unsri.ac.id

Abstract. This research is a descriptive study to see the application of the Creative Problem Solving learning model in the learning process and the problem-solving abilities of students in linear programming. The study was conducted at one of the high schools in Palembang with the subject of all students in class XI MIA 5. The learning process was adjusted to the phases of the Creative Problem Solving model. Researchers use problem-solving questions on the student sheet and test questions. Data collection techniques in this study using the results of student worksheets.

1. Introduction

Based on the Regulation of the Minister of National Education of the Republic of Indonesia No. 22 of 2006 concerning content standards for the Elementary and Secondary Education Unit is set one of the objectives of mathematics subjects so that students can solve problems that include problem-solving skills, design mathematical models, solve models and interpret the solutions obtained [1]. Mathematical models are made as a way to overcome problems that occur in everyday life that the process of solving it uses mathematics [2]. Problem-solving is not only the goal of learning mathematics but also a means to do so applying the knowledge and understanding that it has [3]. The importance of modelling ability is also explained in the National Council of Teachers of Mathematics or NCTM (2000) that there are five mathematical ability standards that must be possessed by students, namely problem-solving ability, problem-solving ability and reasoning and proof, ability communication (communication), the ability of connections (connections) and the ability of representation (representation) [4]. Mathematical modelling is the process of translating between the real world and mathematics in both directions)[5]. Mathematical modelling includes starting out with a real problem, abstracting and solving a corresponding mathematical problem, and then checking the solutions [6]. Mathematical modelling is concerned with enhancing students' performance in mathematics to be part of improving their modelling skills [7]. As a goals of mathematics education the PISA study emphasizes the development of students; capacities to use mathematic in their present life as well as in their future live. It means that students' should understand the relevance of mathematics in everyday of life, to our environment and in sciences and technology [8]. But in reality the problem-solving ability possessed by students is still low, this is by following the 2015 TIMSS study report which ranked Indonesia 45th in the score acquisition of 49 other countries [4]. And this is also in line with the 2015 PISA study report which ranks Indonesia 62nd out of 70 other countries [9]. From the results of the report shows that the problem-solving ability possessed by students in Indonesia is still low. Mathematical problem-solving ability possessed by students is still low, so the planning of mathematics learning needs to be reviewed by the teacher so that it can produce optimal problem-solving abilities [10]. Many factors that express the inability of students to solve a

mathematical problem but the most dominant is the way of teaching a teacher [11]. Furthermore, the teachers still teach with the contextual method in the learning process, especially mathematics learning, then students record the material and work on routine problems, therefore students are not accustomed to solving problems freely and looking for solutions with the results of their thinking and if the questions are given somewhat different from before the students will start to be confused because they are not accustomed to understanding the steps in a problem solving. The success of the learning process is inseparable from the teacher's ability to apply learning models during the learning process that focuses on increasing the activeness of students in the learning process that is taking place. Implementing a learning process basic aims to produce learning conditions that are more active and easily accepted by students so that students can achieve the expected learning outcomes and achievements.

Solving of mathematics equations of student state that student only imitates which is explained by a teacher [12]. The think activities of students in conventional learning class only memorize and understanding process. So, when students were given problems, student could not solve problem solving of mathematics or problem solving of students still low.

Creative Problem Solving is an operational model that can be used to solve a problem using a variety of new ideas and consider a number of different approaches from before to do a problem solving, as well as planning for the implementation of solutions through effective action [13]. In the Creative Problem Solving model, students are given the freedom to do a creativity in the learning process. One of the students is given the freedom to choose the solution as to what they will use in solving a given problem. Therefore it is necessary to apply a learning model based on skills in solving a problem. One of them is Creative Problem Solving. Creative problem solving is not only helps create better solutions, it creates a positive experience that can adoption of new ideas to solve the problem [14].

2. Method

This research uses descriptive research that aims to describe the Creative Problem Solving model in problem-solving learning in Senior High School 10 Palembang. The variable in this study is the mathematical problem-solving ability of students. Broadly speaking, the research procedure is carried out through four stages, namely the preparation, implementation, data analysis, and conclusion drawing stages. At the implementation stage, learning uses the Creative Problem Solving model. 3 meetings were held, between 2 meetings for the learning process and 1 meeting for the test. The steps of learning by applying the Creative Problem Solving model in this study are based on indicators of mathematical problem-solving. With the method of doing learning in the form of groups in which the class consists of 36 students with the number of students in each group totalling 6 people in class X MIA 5 at Senior High School 10 Palembang. The criteria for selecting subjects are seen from their result score from the test based on 3 criteria namely able, able enough, and unable.

Then for data collection techniques done in several ways, namely from the test questions and observation. For the test questions given are questions with the type of mathematical problem solving problems. At the implementation, the stage consists of 3 meetings, with 2 meetings teaching and learning process using the Creative Problem Solving model and 1 meeting for the test. Observations were made when students were working on mathematical problem solving problems-based student worksheet that given at meetings 1 and 2, and when the students working on mathematical problem solving problems - based test questions which amounted to 2 questions at meeting 3.

3. Result and Discussion

After the data is obtained then presented in the form of a table that shows indicators of a problem-solving. Based on a table of indicators that affect the ability of problem-solving that is understanding the problem, compiling a solution plan, doing a settlement plan and looking back.

In the implementation of LPKD 1 and 2 research, the learning process is carried out using the Creative Problem Solving model in problem solving learning. And for problem solving tests given non-routine problems. Here are the results of the problem solving test:

Table 1. Mathematical problem solving ability criteria.

Range of problem solving ability values	Criteria	Frequency	%
90-100	Very Good	6	17.64%
80-89	Good	0	0%
70-79	Satisfactory	2	5.88%
60-69	Poor	4	11.76%
50-59	Very Poor	22	64.70%

Based on Table 1, it can be seen that statistically the problem-solving abilities of students of Class XI Science 5 in Senior High School 10 Palembang consist of 6 categories: students with problem-solving abilities that are very good, god, satisfactory, poor, and very poor. Based on the analysis of the results of tests of students' mathematical problem solving abilities, it can be seen that there are 6 students in the very high category or around 17.64%, 0 students in the high category or around 0%, 2 students in the moderate category or around 5.88%, 4 students with low category or around 11.76%, and 22 students with very low category or around 64.70%

Table 2. Presentation of the emergence of indicator of student mathematical problem solving.

Question Number	Indicator			
	Understand the problem (%)	Draw up a settlement plan (%)	Solve the problem(%)	Re-examine(%)
1	100(%)	71.56(%)	46.07(%)	72.54(%)
2	92.15(%)	47.05(%)	44.11(%)	68.82(%)
Average	96.07(%)	59.30(%)	45.09(%)	70.68(%)

Based on Table 2, the highest percentage of emergence indicators is obtained is an indicator of understanding the problem of 96.07 (%). As for the emergence of the lowest indicator is an indicator of solving problems of 45.09 (%). Each indicator that gets a low percentage is in problem number 2, for indicators planning problem solving and problem solving respectively 47.05 (%) and 44.11 (%). As well as for the re-checking indicator 68.82 (%).

3.1. Understand The Problem
Understand the problem is conduct an analysis of the problem that has been given in the form of what is known, what is asked, whether sufficient information, what conditions must be met, restate the problem in a form that is more easily solved (solved) [14]. This is the point at which creative problem solving begins, without the perception of the solution there is no solution that will be found [15]. The first step is to understand the problem, to solve the problem given correctly students cannot possibly solve the problem if it does not understand the problem given. Learners must be able to show the principle parts of the problem, which are asked, that are known. In Figure 1 it can be seen that students in group 2 can understand the given problem is strengthened by the ability to model the given problem.
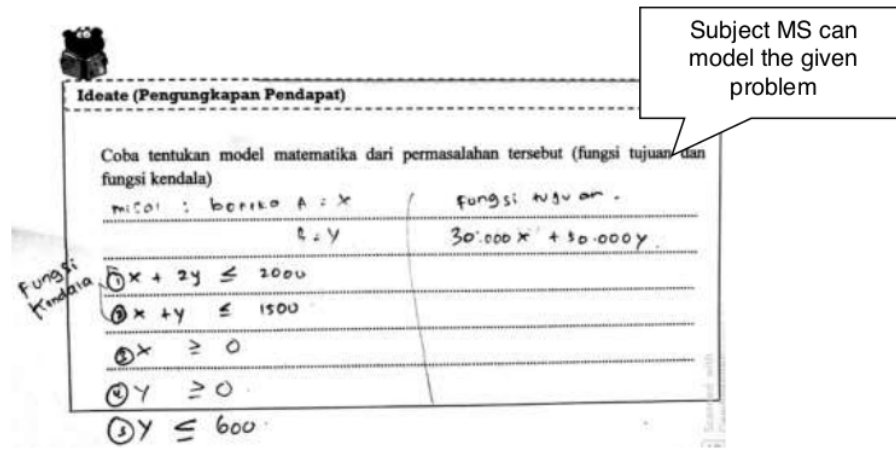
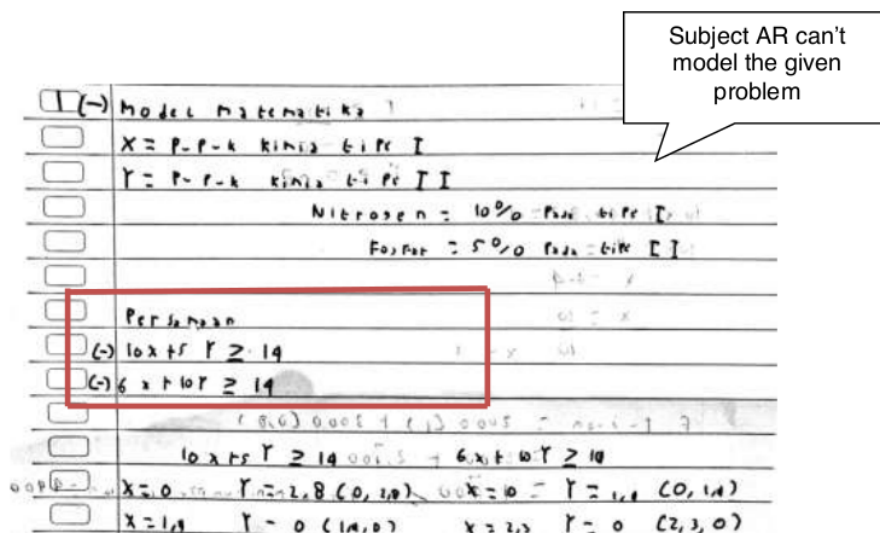**Figure 1.** Student work sheet 1 subject MS at the stage of understanding the problem.

Figure 2. Student test number 1 subject AR at the stage of understanding the problem.

3.2. Draw up a settlement plan

Draw up a settlement plan is way to exploring ideas. It means that student will generate ideas that answer the challenge questions [16]. Students produce as many different ideas as possible to overcome the given problem [17].

Figure 3. Student work sheet 2 subject MA on step draw up a settlement plan.

Figure 4. Student test number 2 subject MA at the stage of step draw up a settlement plan.

4. Conclusion

Creativity and problem-solving skills are also capabilities demanded by today's world of work [18]. Solving problem means finding the right way to bridge the existing gap or in the other words finding way to solve the problem given [19]. Based on the results of the data obtained from class XI MIA 5, it can be concluded that the implementation of learning by applying the Creative Problem-Solving model and with problem-solving questions on student worksheets can be an alternative in learning that asks

students to develop problem-solving abilities. The dominant problem-solving ability that arises is understanding the problem and planning for a solution.

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