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Problem Solving On The Linear Program

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Abstract. Linear program is an optimization program that deals with linear inequality problems. Linear program is one of the topics given to high school students as equals as a tool or an intermediary to train students to achieve problem-solving skills. Problem solving on linear program that can be developed in the form of contextual problem, not routine and open ended. Thus, students are able to improve their knowledge and skills in solving problems related to linear program. The instrument developed in this problem solving has good validity.

Keywords: problem solving, open ended, optimization, linear programing

INTRODUCTION

According to Dennis & Mary (2010: 30) Problem solving is the essence of mathematics. Dennis & Mary (2010: 106) Adding *"....Problem solving is that students develop and construct their own best solutions*". Hence the math over time are dynamic and flexible. So, every problem solving is placed on the learning of mathematics. Linear program is one of the subjects taught at the level of High School Equal. Terms before learning linear program is the students have mastered the concept of equations and linear inequality either two variables or three variables. These subjects require students to be able to determine the value of the variable so that students can change the day-to-day problems in the forms of symbols and mathematical models, or vice versa. The existence of these linear program subjects hope that students are able to apply linear program in determining capital and profits on the entrepreneurship and make appropriate doses on things to work, and so forth.

NCTM asserts that problem-solving ability is one of the most important aspects in shaping the students' mathematical literacy skills. Problem solving on linear programming certainly involves mastering the understanding of the types of questions and answers so that when faced with the contextual problems linear program will be easily solved. For that we need studies that discuss about problem solving problem in linear program.

Understanding Mathematical Problem Solving

Problems and not problems are relative to students. So, it depends on the context and condition of the students, for example:

> Tina bought 6kg apple for Rp36.000,-. He resells at Rp7.000,-per kilogram. How much is the benefit?

This is a problem for elementary school students and not necessarily a problem for high school students. Therefore we need to understand the characteristics that a problem can be said to be a problem or not a problem.

Yimer (2010: 1) "Problem solving is a condition where one solves every problem at hand". Affirmed by Bell (1978: 310) who states that circumstances are a problem for a person if he or she realizes, knowing the situation needs to be resolved, feel like facing to complete but not necessarily be resolved soon. If the student is faced with a type of problem that he often does so that he does the procedures he has in accordance with his experience then the matter is a matter of routine and not a problem for the student. On the other hand, if the students are faced with the type of problem with different modifications so that students have difficulty in doing so the problem is a problem for him but if the student can do well and right then the student passes in solving the mathematical problems. This will be a new finding for the student if at a later time encounter a similar or slightly modified problem.

In line with the above understanding of the problem that there are three things that something is said to be a problem according to Ruseffendi (2016: 335-342) and Schoen (1980: 216) that is the first problem is not yet known the procedure to solve it because the problem already known the settlement procedure is a routine problem. For example in case of linear program:

> Ani is a premium and regular waffle entrepreneur. To make a regular size waffle dough required sugar as much as 2 kg and 5kg flour, while to make one dough of premium waffle required 4kg of sugar and 10kg of flour. If available 32 kg sugar and 110 kg of flour, if each dough produces 10 cakes and the price of a premium waffle is Rp8.000,- and the usual size is Rp4.000,00. What amount of dough should be made and sold out for maximum Ani income?

Problem solving according to Laura (2010: 10) "an attempt to find the right way to achieve a goal when the goal is not immediately achievable. The solution of the problem put forward by Schunk (2012) that "problem solving refers to the efforts of people to achieve goals because they do not have an automatic solution. Branca, N. A in Krulik, S. & Reys, RE, 1980: 3-6) interprets the term problem solving into 3 different things in mathematics learning, namely (1) problem solving as goal (as a goal) as one of the goals of learning mathematics. If problem solving is defined as a teaching objective then it is not dependent on a particular problem or problem, procedure or method and also the content of mathematics. An important assumption in this case is that learning on how to solve problems (solve problems) is the "primary reason" (mathematics learning), (2) problem solving as the process (as a process) that problem solving can be interpreted as the process of applying everything knowledge possessed in new and unusual situations. In this interpretation, what needs to be considered are the methods, procedures, strategies and heuristics that students use to solve a problem? This process problem is very important in learning mathematics and this is often the focus in the mathematics curriculum. And (3) problem solving as a basic skill, some of which are proposed include numeracy skills, arithmetic skills, logic skills, "mathematics" skills, and others. Another one that is either implicitly or explicitly often expressed is the problem solving skill. It is undeniable that every day we humans are always dealing with problems, whether we realize it or not. Realized or not. Therefore, early problem-solving learning is needed so that students can solve their life problems in a broad and narrow sense.

In learning mathematics on linear program material will often encounter problems such as contextual problems on the problem is a matter of routine. Solving this problem just make or without create a table according to the problem without thinking deeper and make a mathematical model. Furthermore, completing using point test corner or line of investigation it will be known optimal value. Something said the second problem is if the problem is in accordance with the level of student thinking because the problem is too easy or too difficult to do is not a problem. Third, if students have the desire to do or finish. So, bringing the wishes of students to solve the problem then make a problem that the level of difficulty slightly above his ability and still naturally. For example in case of linear program:

A total of 1 kg of thumb cap food contains 10 units of antibiotic A and 3 units of antibiotic B. While 1 kg of rabbit chicken food contains 5 units of antibiotic A and 12 units of antibiotic B. Every day 5 chickens need at least 60 units of antibiotic A and 48 units of antibiotic B. Weight chicken food thumb cap and rabbit cap required for 5 chickens every day at least 10 kg.

a. How many kilograms of both types of food required 5 chickens every day to spend as little as possible. What is the minimum cost?
b. Two of the chickens incubated each of 5 chicken eggs. The chicks require food as much as a quarter of a portion of 5 chickens. What is the additional cost for chicken food that has been hatched?
c. If the price per kilogram of chicken food thumb sticks Rp1.000,00 and cap the rabbit Rp2.000,00. What is the maximum and minimum price incurred?

Armed with the mathematics learning of linear program materials to solve the above problems as in routine problem procedures is not enough. Students are required to calculate the addition of the problem b that is "Two of the chickens incubate each of 5 chicken eggs. The chicks require food as much as a quarter of a portion of 5 chickens". If it illustrated then:

1. Two hens hatched five each then there are 10 chicks.
2. Portion 5 chickens as much as 10kg then 10 chicks require a quarter of the portion of 5 chickens is 2.5kg.
3. Then the portion provided for the whole chicken feed as much as 12.5kg

In meeting the needs of the problem-solving type problem on the linear program material then it needs a problem that meets the criteria of problem solving in general. Based Fung and Roland (2004) a good problem in mathematics for students should meet the following criteria:

1. There is more than one way / method of completion
2. It takes more than one step to complete
3. Using a clear and non-multi-interpretative language
4. Interesting (challenging) and relevant to the daily life of students
5. Containing real or contextual mathematical values (concepts) so that the problem can improve understanding and expand students' mathematical knowledge.

Develop Problem Solving in Linear Courses

Problem solving problems in linear program contains several things according to the criteria of problem solving that is:

1. In developing problem solving problem of course have some alternative method of settlement. This linear program material already has two alternative that is point test corner and use line of inquire. So in the application of problem solving problems in this linear program does not need to write down the settlement method used. So students have the opportunity to choose methods that students find easy to do.
2. In addition to having several alternative methods of settlement, we also need to estimate some alternative answers so that in solving the problem solving students find some correct answers called open answer.
3. Contains problems not routine so that the problem will be modified so that students will release the maximum creativity in the process.

The problems we can develop are as follows:

Mom Kartika makes two kinds of cakes. A type of cake requires 50 grams of butter, 150 grams of flour and 50 grams of sugar. Type B cake requires 100 grams of butter, 100 grams of flour and 50 grams of sugar. Ingredients available 4 kg butter, 6 kg flour and 3 kg sugar to make x fruit cake type A and y fruit cake type B.

From the results of baking, mom Kartika entrusted to the school cafeteria 10 cake type B where the price on the canteen got courted to Rp750,00 while the rest mom Kartika sell on the market with the normal price of one type of cake Rp1.000,00 and one cake type B Rp2.000.00. Calculate the maximum revenue!

The results of the expected problem resolution are as follows:

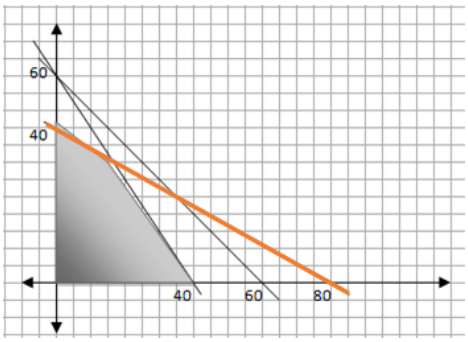
Alternative 1: Selection Method

Point of sight lines, using the normal price:

$(1)....f(x):1.000x+2.000y=....$

$x+2y=80$

$(0,40)(80,0)$



The points obtained (0.40) and (20,30) as the maximum point

Alternative 2: Corner Point Method

Means the number of cakes sold are 20 cakes A and 30 B cakes or just 40 B cakes for maximum income, then:

Point	Place	Point	Income	Information
(20,30)	Canteen Market	(0,10) (20,20)	7.500 60.000	mak
(0,40)	Canteen Market	(0,10) (0,30)	7.500 60.000	mak
(40,0)	Canteen Market	(10,0) (30,0)	10.000 30.000	

Results Aiken Validity

Validity of content is determined by agreement of experts. The agreement of experts in the subject of mathematics or often called a domain that is measured determines the level of validity of the contents of the instrument. The scores obtained from the results Aiken validity are:

Item	Score	s	V	Information
1	3	2	0.5	Medium
2	4	3	0.75	Medium
3	4	3	0.75	Medium
4	5	4	1	High

CLOSING

Problem-solving skills play an important role in learning linear programming materials in particular and math in general. Problem solving on linear programs involves contextual questions. Linear program problem solving method is open way so it has more than one method. The answer to the problem solving is open answer so that it has more than one correct answer.

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