Students’ high-level thinking skills in creative problem solving learning model

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Abstract. This research is a quantitative research. This study aims to look at students' higher order thinking skills to solve linear equations after learning with creative problem solving models is given. The subjects of this study were the XI grade students of SMA N 5 Palembang. The data collection technique used was a test in the form of a description consisting of three questions. Based on data analysis that students' high-level thinking skills in learning linear equations are categorized low.

1. Introduction

One of the competencies that need to be approved by all high school students is creative motivation to solve problems [1]. This is supported by the participation of mathematics learning that is agreed upon in problem-solving with a creative problem-solving learning model [2]. This creative problem-solving learning model emphasizes students' creative thinking, so it is hoped that students will be able to think creatively, critically, and skillfully at solving problems. This is important because it restores the 21st-century skills needed by students regarding learning and innovation skills, literacy, character, and life skills [3]. Literacy and competencies as well as the main objectives of mathematics learning and curriculum competencies, namely the ability to think skills at a higher level [4].

The goal of high-level mathematics learning in schools is to make quality human learners, so they can survive in facing the challenges of global development [2]. Therefore high order thinking skills become one of the priorities [2]. The purpose of this study is to look at students' higher-order thinking skills with creative problem-solving learning models. High-level thinking is the ability where students can argue, solve problems, provide explanations, distinguish ideas or ideas, and complex things become clear [5]. Higher-order thinking skills take place when students connect the information they know with new information and rebuild information to resolve difficult circumstances [6]. The main purpose of higher-level thinking is how to improve students' thinking abilities to the highest level [7].

Bloom's taxonomy is assumed to be the basic concept of high-level thinking, this is because more thought processes are needed for certain types of learning, but the benefits are more general. In Bloom's Taxonomy, The ability to think at a higher level is the ability to analyze, evaluate and create [8]. In its revision A Revision of Bloom's Taxonomy: An Overview reveals indicators to measure higher-order thinking skills including analyzing, evaluating, and creating [9]. For this reason, the indicators in this study are to analyze, evaluate and create.

To improve students' ability to think at a high level the right learning model is a problem-solving learning model. This is because students are given as much opportunity as possible to solve the problem based on their strategy. The development of this learning model is the Creative Problem Solving (CPS) learning method [10]. This CPS learning method was originally formulated by Alex
Osborn and Sidney Parnes in 1940 who developed spontaneous creative abilities in education. Also besides, he revealed that everyone will be creative through the teaching and learning process. The Parnes-Osborn model is built on the concept of brainstorming which emphasizes the divergent-convergent cycle.

Creative Problem Solving (CPS) learning method is a learning method that focuses on teaching and problem-solving skills, followed by strengthening skills. When faced with a problem, students can perform problem-solving skills to choose and develop their responses. Not only by memorizing without thinking, but problem-solving skills also broaden the thought process. The process of the Creative Problem Solving (CPS) learning method consists of the following steps [11]: Clarification of the problem: includes giving an explanation to students about the problems raised, so that students can understand about the solution as expected, Brainstorming / Disclosure Opinion: At this stage students are freed to express opinions about a variety of problem-solving strategies, Evaluation and selection: At this stage each group discusses which opinions or strategies are suitable for solving problems, and Implementation: At this stage students determine which strategies are determined, can be taken to solve the problem, then apply it until finding a solution to the problem.

It can be concluded that the Creative Problem Solving learning method is suitable to be used in increasing the ability to solve problems because in this learning method prior experience in solving a problem is an important factor in solving new problems that are different.

2. Method

This study uses quantitative descriptive research. Quantitative research is a method used to test certain theories by examining the relationships between variables. In this study, the population is students of class XI Science 5 in SMA Negeri 5 Palembang. The sample in this study used purposive or purposeful samples according to certain criteria. Variables are variations on the research object. The variable in this study is the ability to think of students at a higher level. High-level thinking ability is the ability of students to analyze, evaluate, and create a problem that will be seen from the scores obtained by students through tests.

In this study data collection techniques with tests. The test is used to determine the extent of students' high-level thinking skills in solving HOTS questions on linear program material with the creative problem-solving method. The form of the test given is an objective test in the form of a description which amounts to 3 question items. The form of the test given is a description to make the students' thinking process clear and how students express their answers. Interviews are used to find out more about how students' abilities in answering questions. The instrument in this study was a matter of higher-order thinking skills and an interview sheet. The test result data to measure the ability of high-level thinking in students is seen from the scores obtained by students through tests.

Data on the results of tests to see students' higher-order thinking skills can be seen from the scoring obtained from working on student test questions. Test questions are then checked with the guideline guidelines then the results are analyzed according to the results obtained.
3. Result and Discussion

Higher-order thinking skills take place when students connect the information they know with new information and rebuild information to resolve difficult circumstances [6]. The main purpose of higher-level thinking is how to improve students' thinking abilities to the highest level [7]. This relates to the ability to think critically in receiving various types of information, think creatively in solving a problem using the knowledge possessed and make decisions in complex situations. The ability to think at a higher level requires students to understand, infer, connect facts and concepts, categorize, manipulate, then unite them in new ways (create) and apply them when searching for new solutions to new problems[18]

The results of the analysis of high-level thinking ability tests are categorized into 5 ability categories, which are very good, good, sufficient, less and very less. Each of these categories has different value intervals. The value interval for each category is adjusted to the value in SMA Negeri 5 Palembang with the compulsory Mathematics KKM is 67. Following the analysis of data from students of grade XI, IPA 5 in SMA Negeri 5 Palembang can be seen in Table 2.

| Score Intervals | Category    | Frequency | Percentage (%) |
|-----------------|-------------|-----------|----------------|
| 86-100          | Very Good   | 6         | 17.14          |
| 75-85           | Good        | 2         | 5.71           |
| 67-75           | Satisfactory| 3         | 8.57           |
| 31-66           | Poor        | 17        | 48.57          |
| 0-30            | Very Poor   | 7         | 20             |
| **Average**     |             | **56.818**|                |

Based on the table it can be seen from 35 students that there are 17.14% of students with very good categories, 5.71% of good categories, 8.57% of satisfactory categories, and 48.57% of the poor categories, and there are still 20% of very poor categories. The categories are based on the values obtained by students from the results of test analysis in the form of score scores.

Research on high-level thinking skills in learning linear programs with creative problem-solving learning models aims to see the high-level thinking skills of class XI students of SMA Negeri 5 Palembang. The description of students' high-level thinking skills is obtained from the results of high-level thinking ability tests conducted after learning with the creative problem-solving learning model. Learning is done based on the steps of learning creative problem solving that has been discussed with the supervisor and has been through the process of validation by experts, in addition to the learning process of creative problem-solving models that have been adapted to the process of learning mathematics.

Based on tests of high-level thinking ability of class XI Science 5 students totaling 35 people for the results of data analysis can be seen in the table. In the analysis of the test results if we combine the scores of students categorized very well and well there are as many as 8 students or as many as 22.85% of students categorized as having good high-level thinking skills and there are 17 students with fewer categories or as many as 48.57%. In the linear program questions with high-level thinking ability indicators, namely: analyzing (C4), evaluating (C5), and creating (C6) contained in three items including numbers 1, 2, and 3. In the indicator analyzing 35 students of class XI IPA 5 able from questions number 1,2, and 3. Each question consists of three indicators of higher-order thinking, the indicator evaluates that most students are capable.

In creating indicators for question number one 14 students get a score of 4, 10 students get a score of 3, for question number 2 only two people get a score of 4 and 3 people to get a score of 3 and 4 people to get a score of 2, question number 3 only 2 people get a score 4, 11 people get a score of 3 and 1 person gets a score of 1. Of these three questions, students have difficulty when creating where they have to find a corner point. This is in line with research conducted [11, 12] which says that the ability to think at a high level is low, this is because students are easier to work on analyzing indicators than creating that in working on problems requires the incorporation of information to produce new
ideas in its completion. Something similar happened in the study [13] in a study conducted by Anjani revealed that MAN 2 Kudus students have not been able to reach the level of creating high-level thinking skills in linear program material.

4. Conclusion
Indicators of high-level thinking ability, namely analyzing, evaluating, and creating. Based on the results of research in class XI IPA 5 SMA Negeri 5 Palembang that the high-level thinking ability of students in linear program material is lacking in detail with details: 6 very good students, 2 good students, 3 good students, 17 less students, and 7 very students less with an average value of 56.818 and the average grade XI science student 5 SMA Negeri 5 Palembang categorized as lacking in high-level thinking skills. Where almost all students have been able to reach the analysis stage and some students have been able to reach the evaluation stage, and there are still many who have not been able to create. Some of the obstacles that become the cause are students who are still having difficulty in making mathematical models, it is difficult to distinguish the question of minimizing and maximizing and the number of each object being asked which is accompanied by reason, still experiencing errors in determining the corner points with new ideas.

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