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Creative problem solving; implemented study in biology content

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Abstract. The form of classical teaching was still the mostly used in teaching and learning form but for certain fields other forms of teaching are needed such as creative problem solving. The purpose of this form of teaching aimed at teaching students to think at a higher order thinking skill, one of which is problem solving that requires creative thinking skills. This study aimed at determining students' prior knowledge in solving problems creatively using creative problem solving. The focus of this study was a discussion of environmental pollution using the teaching steps of creative problem solving. Respondents were students of Study Program of Biology Education. The research instrument was a discussion sheet with the topic given "environmental pollution". Data analysis used was descriptive statistics. The results of data study were; (1) the results of the students' achievement were 6 (34.5%), 7 (20.8%), 5 (17.2%), 8 (13.8%), 4 (10.3%), 3 (3.4%), (2) the results of Creative Problem Solving (CPS) were; clarification 58.6%, ideate 72.4%, and developing 27.6%. It can be concluded that students were less in solving problems creatively in "environmental pollution" material.

1. Introduction

The challenges of an everchanging future and increasingly fierce competition require educational output that is not only skilled in a field but also creative in developing the fields of interest. Therefore, education must be active in preparing educated human resources who are able to face the challenges of life among locally, regionally, nationally and internationally. In science education, it is very important to encourage students' problem solving ability to solve problems in the real life situation. Independent thinking and problem solving are very important for students to develop their mapping potential [1]. [2] in the current problem, creativity in solving problems is very important for someone to solve a complex problem. Students tend to engage in memorization so that it limits the ability of creativity and problem solving, so he proposes a project to solve problems creatively [3]. In contrast, it was done by [4] namely analyzing student creative ideas in biotechnology courses on the concept of implementing biotechnology in various fields including in the fields of Food, Environment, Health, Forestry, Animal Husbandry, Plant Breeding, Mining, and Biodiversity. Therefore, the instructor is expected to be able to innovate learning that can stimulate the students' creative thinking skills for each concept or topic taught especially those related to the environment. [5] a learning model is needed during learning process by involving students in working together to share creative ideas. Creative problem solving is one approach to create various solutions (requires divergent answers) to solve problems [6, 7]. However, divergent thinking is related but it does not the same originality with creativity [8]. Although originality of an



important part of creativity is not enough to explain creative phenomena. According to him, creativity testing is not to test creativity but their potential to predict problem solving creatively.

Training the way of thinking in solving problems through various methods of constructivist learning, and educators are also required to master these methods in the learning process. Problem solving skills are special ability that lead to be creative thinking and use the principles or symptoms of the past to accomplish a number of tasks. Some important notes why CPS needs to be applied in learning, i.e. (1) to develop creativity and innovation in their environment. (2) To grow creative thinking, and (3) to practicing creative problem solving in the community.

At the university level, learning still occurred that lacks training in higher order thinking skills, one of which is the ability to solve problems creatively. The lack of training in creative problem solving skills is one reason because during learning, especially during discussion, the questions were asked only answers/thoughts requirement that were cover genic, namely the ability to find the most appropriate answer to the problem given based on the information available. Based on the above description, the question of this study was whether or not the student was able to express some alternative answers on biology materials through creative problem solving and the purpose of this study was to find out the students' prior knowledge in solving problems creatively using creative problem solving.

2. Methods

This study used descriptive statistics method, which was used to analyze data by describing the data collected as it's without generalizing in making conclusions [9]. The participants were 29 students the fourth semester of study program Biology Education, Hamzanwadi University in the academic year 2016/2017. Data collection used was students' worksheets on "environmental pollution". Data analysis was conducted by calculating the respondents' answers then presenting. The learning process was conducted on May 28th 2018 at Hamzanwadi University.

3. Results and Discussion

The meaningful learning is happened when we are able to provide interesting things, motivate the students in learning, and students are able to provide and express good, correct, and divergent answers. Meaningful learning is also inseparable from teaching methods implemented by lecturers in the classroom. Teaching method used is only dominated by the lectures and the questions, it makes students feeling bored because learning is only centered on the teacher (teacher centered learning). Unlike the case with constructivist learning, that is emphasizing students' activities, this type of learning is more emphasized in student centered learning. [10] compared creative problem-solving lessons using traditional didactic teaching, and it turns out that compared creative problem solving can improve students' positive attitudes towards learning cultivation of problem-solving ability.

The creative problem solving is one of the constructivist learning techniques used; this research was conducted in biology teaching and learning strategies. Student worksheets given to each student to determine their initial ability to solve problems creatively using teaching steps of the creative problem solving are Clarify, Ideate, Develop and Implement. From these 4 steps, 3 of them are used to find out the initial ability of students namely Clarify, Ideate, and Develop because Implement is related to the application of the develop proposed results. Additionally, using MFIs you can also use WCR tests (Widening, Connecting, Re-organising). WCR is traditional instruments include daily activities and stimulate the use of repetitive strategies because the WCR evaluates three mental operations involved in creative thinking [11].

There are 4 stages that will be do by students in implementation of creative problem solving (CPS): 1) clarify is students formulate problems and collect data, 2) ideate is students generate ideas to answer questions, 3) develop is students formulate solutions to answer the question challenge, and 4) implement is student make a plan to be implemented based on the proposed solution [10].

Based on the findings, the students answered the questions on the students' work sheet for 30 minutes. After analyzing, the students' scores were 3,4,5,6,7, and 8. The highest score for each creative problem-solving indicator was 3. It can be seen in Figure 1.

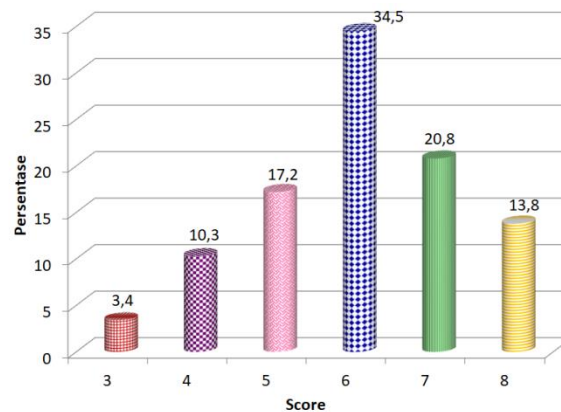


Figure1. Score of achievement using Creative Problem Solving

In teaching and learning process, students need to behave in solving the problems, find some important thing for themselves, and try to create innovative ideas. [1] creative problem solving encourages students to solve problems well with the aim to overcome creative problems and create innovative ideas. The main role of educators in implementing creative problem solving is as a facilitator, they are not as a tutor, educators instruct and guide students during the learning process to assist students in issuing their ideas by giving analogies because they can stimulate student thinking. [12] found that in implementing creative problem solving, teachers act as a facilitator in the learning process to cultivate students' attitude, consider other people's opinions, reservation attitude, and unsuspecting.

In addition, to analyze the students' learning outcomes using creative problem solving, researcher also analyzed the creative problem solving abilities of students for each indicator. The aimed at finding out the students' ability to present answers to each creative problem solving indicator by giving a score for each answer, namely a score of 3, 2, and 1. On the clarify indicator; score 1 (69%), score 2 (58.6%), score 3 (34.5%). Ideate indicator; score 1 (13.8%), score 2 (72.4%), score 3 (13.8%). Develop indicators; score 1 (72.4%), score 2 (27.6%), score 3 (0%).

From these data, it appears that a score of one was obtained by many students on clarify and develop indicators. The assumption of the researcher, students were not able to develop the ideas put forward, and students seemed confuse about how to develop the ideas obtained (The results were presented in graph 2). [13] uses 4 stages in creative problem-solving implementation that is generation, conceptualization, optimization, and implementation. Each stage, each individual has different preferences and problem solving styles. [14] explains creative problem solving is ability to think in solving problems to find new things and different than unusual. Creative problem solving is new in learning process, complicated, and unclear. Therefore, to facilitate its implementation begins with defining the problem used as a basis for gathering information [15].

Based on the above case, the learning process needs to be trained in the thinking habits of divergent students through small discussions both in the classroom and outside the classroom, intense discussions between teachers, among students having problems found can be solved using imaginative solutions and innovative. The goal is to make learning interesting, as expressed [16] that teaching creative problem solving can significantly increase students' interest in learning in social studies. The same thing was expressed by [10] about problem solving creatively by finding the best solution and gives the various a reason.

Creative problem solving is a creative method and learning process uses open and challenging questions which require imaginative and innovative thinking in answering. [17] students need knowledge and skills that involve a level of cognitive, divergent, motivational, and supportive thinking in order to have creative problem-solving abilities.

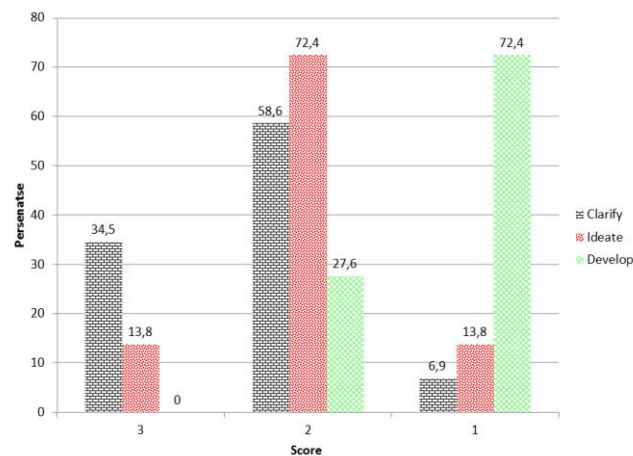


Figure 2. Score of indicators creative problem-solving Indicator

In implementing of creative problem solving, cohesiveness of TIM is needed because the success of TIM work affects the results of the creative problem solving application. [18] stated in the results of his research stated that the default of project can be addressed with the team's commitment, different thinking, performance and output process. [19] concluded that student learning performance was better at achieving logic programming after implemented creative problem solving in teaching and learning. Creative problem solving make students to focus on problem solving skills, followed by strengthening the skills [20].

In implementing creative problem solving in the classroom, the main thing that must be emphasized by the instructor is how to find problems, and define problems because the estuary of solving problems creatively is from both of them. In addition, the teacher plays an important role as a facilitator so that students more understand the meaning of creative problem solving, so that their understanding is not divided between problem solving, because creative problem solving is often equated with the meaning of creative thinking, and only means problem solving.

4. Conclusion

Creative problem solving is one method of teaching that are constructivist, trains and students teaching to think divergent in solving problems that are challenging creatively, imaginative, and innovative. To solve these problems by conducting the teaching steps among Clarify, Ideate, Develop and Implement. The results obtained after testing the creative problem solving using the students' work sheet, those were; the score for each creative problem solving indicator was score 1 (69%), score 2 (58.6%), score 3 (34.5%). Ideate indicator; score 1 (13.8%), score 2 (72.4%), score 3 (13.8%). Indicators develop; score 1 (72.4%), score 2 (27.6%), score 3 (0%) and can be interpreted that students still could not reach creative problem solving.

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