Using Discovery Learning to Encourage Creative Thinking

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Abstract: Creative thinking ability development is needed to be implemented by every educator including lecturers to their students. Therefore, they need to seriously act and design their learning process. One of the ways to develop student's creative thinking is using discovery learning model. This research is conducted in physics education study program in 2016 with students who took learning and teaching class as research subject. From the research analysis result and discussion, it can be concluded that discovery learning model can encourage students' creative thinking ability in learning and teaching strategy subject.

Keywords: Creative Thinking, Discovery Learning

1. Introduction

Creating or shaping new idea from thinking result is a creative way of thinking. Creative thinking is an ability owned by individual to formulate problem solving (Sternberg, 1988), in other words, an individual with good creative thinking ability will make such individual also has a good ability on solving the problems they face (Gee, 2003). Piaget (as cited in Bräuchler, 2009) stated that education main purpose is to create human beings who are capable in doing new things, not only use the previous generation's creation. Meanwhile Ginsberg and Opper (as cited in Hadzigeorgiou, Fokialis, & Kabouropoulou, 2012) said that the second purpose of education is to build understanding and how the students are able to verify and not easily accept what have been done.

Developing creative thinking ability for the students requires a creative lecturer. Creative lecturer is a lecturer who is able to actualize all the abilities to optimally educate, train, and guide the students in accordance with the expected purposes (Carter & McRae, 2014; Craft, Hall, & Costello, 2014; Sternberg & Williams, 1996). Creative lecturers will also find new strategies to develop the potentials of the students. The lecturer must attempt to create comfortable and pleasing learning environment for the students in a way that made them able to explore all the abilities they have.

Lecturer need to develop students' creative thinking from the early beginning, since student's creative thinking make them able to solve the problems they have (Pithers & Soden, 2000). This is in accordance with English, Lesh, and Fennewald (2008) who argued that thinking ability need to be developed from the early beginning, since it is expected to equip them in facing daily problems. The thinking ability is also an instrument to achieve education goal, i.e., the student's ability to solve high level problem.

The discussion and research on creative thinking have been conducted by many researchers, i.e., Gregory, Hardiman, Yarmolinskaya, Rinne, and Limb (2013) in their writing stated that the student's creative thinking ability will grow due to the influence of several factors that can be directly stimulated in the class rooms, e.g., by giving chances to student to ask question. Classrooms often give too few chances for the students to think creatively, but creative thinking and problem solving can be shaped with various ways, among others are lecturer can encourage the students to find new connection between different ideas or to ask the students to offer several and various solutions to complex problem (Brooks & Brooks, 1999; Sternberg & Williams, 1996). If the lecturer think creative thinking is important for students' success, the lecturer must explicitly encourage and teach creativity to the students. Next, Torrance and Safter (in Hamza & Griffith, 2006) said that in order to make the students learning creatively the students should be encouraged to explore, question, experiment, manipulate, listen, and test the problems they face. The students will learn better, be more critical in thinking, and more able to think creatively if they learn in safe environment (Brookfield, 2017). Safe environment will make students feel more comfortable to deliver their opinion and ideas, to take risk, to be open to changes, to be creative and have concern.

Developing students creative thinking ability can be done by the lecturers by developing learning model that train the students to discover. One of learning and teaching strategy is discovery learning model. Discovery learning model means that in learning, the students need to be trained to find the concepts or theories relevant with the taught materials (Bruner, 1961; Janssen, Westbroek, & van Driel, 2014). Learning with discovery always involves the students to discover from their learned problem and the experiences they have. Discovering by themselves or solving the problems they face will require the students to develop creative way of thinking. This is in accordance with one of discovery's purposes in learning, i.e., to develop creativity and critical thinking ability (Ausubel, 1964).

Discovery learning is a learning model, where students build their own knowledge by conducting experiment to find a principle from such experiment (Saab, Joolingen, & Hout-Wolters, 2005; Van Joolingen, De Jong, Lazonder, Savelsbergh, & Manlove, 2005). Furthermore Shulman and Keisler (in Mayer, 2004) stated that learning with guided discovery model generally is more effective than pure discovery (Kirschner, Sweller, & Clark, 2006). There are several students who do not learn the rule or principle with pure discovery, but instead with guided discovery. The guided discovery model is perceived as more effective model since this model can help the students to fill two important requirements in active learning, (1) activating or building knowledge to make understanding of the new information and (2) integrating the acquired new information until they discover the correct knowledge (Alfieri, Brooks, Aldrich, & Tenenbaum, 2011; Leutner, 1993). Pure discovery model can fail if it is unable to help the students building the knowledge stated in the two requirements. Bruner said that

discovery learning model is a model where the students are allowed to discover new rule and new ideas, not memorizing what is said or delivered by the teacher (Bruner, 1961; Mayer, 2004).

2. Method

This research used class research method focused on discovery learning model implementation in studying, learning and teaching strategy to encourage student's creative thinking. This research aimed to study the enhancement of creative thinking ability by using discovery learning model. Variable in this research is students creative thinking ability that can be seen from student's ability to solve the designed test adapted to the creative thinking ability indicator.

This research was conducted in Khairun University of Ternate at Physics study program students of 2016/2017 academic year between October and November 2016. The research subject was 44 students. To measure creative thinking ability, this research used a developed questionnaire (reliability = 0.899; validity = 0.608—956) of 10 items. Creative thinking ability test used the following equation:

$$x = \frac{The\ Acquired\ Score}{The\ Maximum\ Score} x\ 100\%$$

With following criteria:

81—100 : highly creative

65—80 : creative

40—64 : quite creative

< 40 : less creative

3. Results and Discussion

Creative thinking ability in this research consisted of fluency, i.e., generating many ideas in various categories, originality, i.e., having new ideas to solve problem, and elaboration, i.e., the ability to solve the problem in detail (Kim, 2006). The creative thinking ability result in this research is shown in Table 1 below,

Table 1: Summary for descriptive analysis result

Component	Pre-test	Post-test
Maximum Score	76	88
Minimum Score	25	50
Range	51	38
Average	52,66	69,39
N	44	44

Table 2 shows that during pre-test there were 12 students in the less creative category (27.2 %), 16 students in the quite creative category (36.4%), 16 students in the creative category (36.4%), meanwhile there was none in highly creative category. After the treatment, the post-test shows there were 4 students in the highly creative category (9.1%), 29 students in the creative category (65.9%), 11 students in the quite creative category (25%), and none in less creative category. For clearer view towards students creative thinking ability, the following table 2 can be observed:

Table 2: Students creative thinking ability test

Component	Pre-test	Post-test
Less Creative	12	0
Quite Creative	16	11
Creative	16	29
Highly Creative	0	4
N	44	44

The creative thinking ability indicator percentage recapitulation report during pre-test for fluency indicator was 47.73%, originality indicator was 68.18%, and elaboration indicator was 50%. Meanwhile during post-test, the creative thinking ability increased for each indicator. Fluency indicator increased to 66%, originality indicator increased to 77.27% and for elaboration indicator increased to 68.18%.

That data analysis shows that creative thinking for all indicators increased after the students taught using discovery learning model. Therefore, from that research it can be said that discovery learning model is effective for physics learning and teaching because this model can give opportunity to students to search and discover the principles of the problems they faced. By using discovery learning model, students are involved directly in learning the problems, to find the answer through searching and discovering the problem. This research is in tune with the opinion of Zydney et al., (2012) that stated discovery learning model gives room for students to learn in making decision and to make new competency.

4. Conclusion

From the research analysis, it can be concluded that discovery learning model can encourage students' creative thinking ability in learning and teaching strategy subject. This can be seen from the decreasing number of students categorized as less creative, from 27.3% during pre-test to 0% during post-test, and the increasing number of students categorized as highly creative, from 0% to 9.1%. There has been an increase in average score of creativity level of 16.73 points. This research implies that using discovery learning model is one of the options to enhance students creative thinking ability. This learning model should be implemented in various field of education. Research with the same topic should be conducted in the future, with variability of the subject education level or different education institution settings.

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