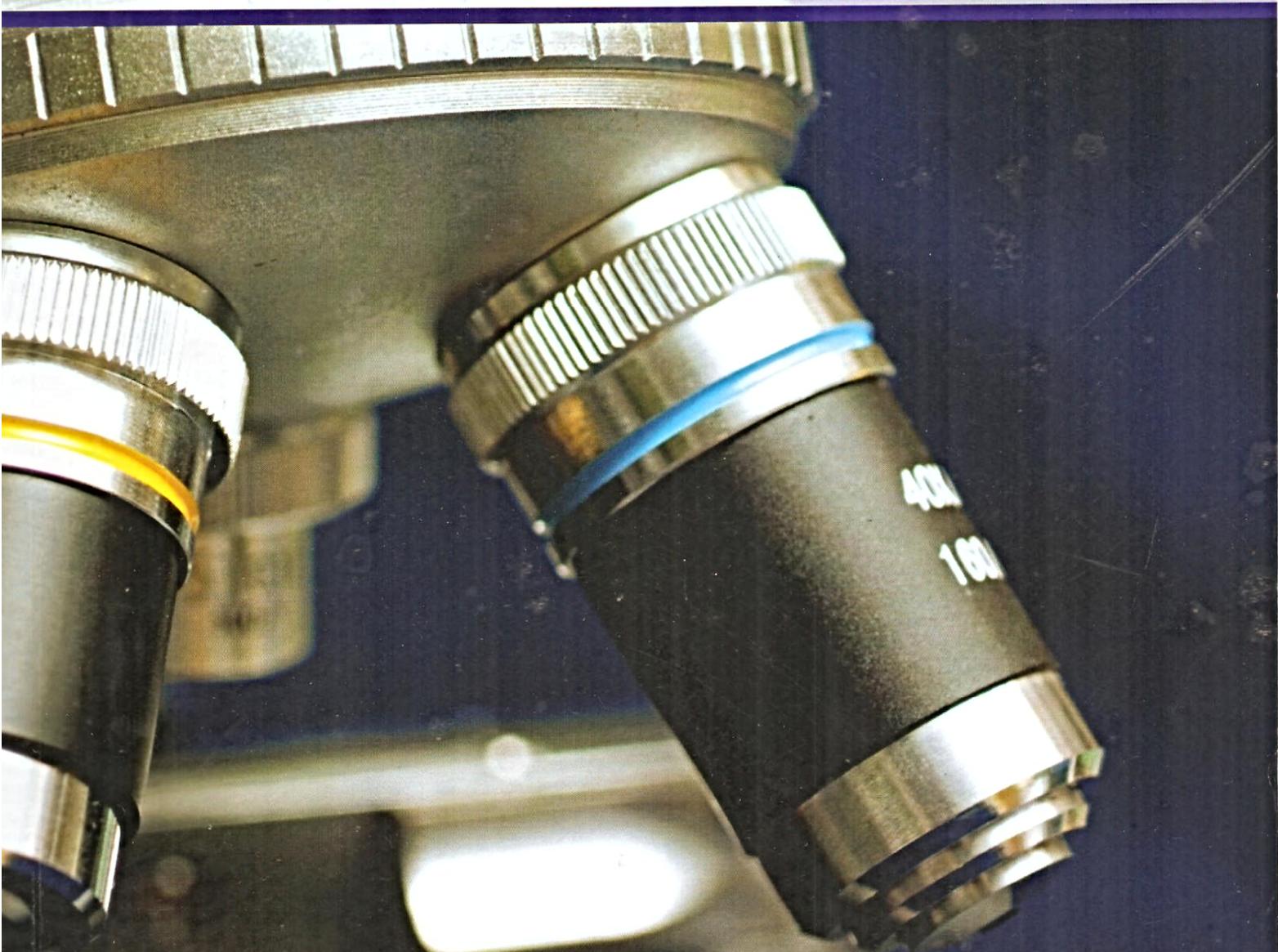


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## THE ANALYSIS OF STUDENTS' CREATIVE THINKING ABILITY USING MIND MAP IN BIOTECHNOLOGY COURSE

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### ABSTRACT

Process of learning which generally practiced nowadays is mostly in the form of face-to-face (lecturing) and one way communication. Sometimes the students are given tasks to fulfill the material target in one semester such as papers, internet-based summary, and/or other articles. Such things cause learners accustomed to convergent thinking and not to divergent thinking. Mind map is one of creative products which conducted by learners in learning process. Learning with mind map focuses more on the activeness and creative activity of the students. It will improve their ability to memorize and strengthen concept understanding of the student, and improve their creative thinking ability. This research was focused to analysis the creative thinking skills students using mind mapping in biotechnology course. The participant was students of Biology Education (N=55) consisting of two team that was team A (N=25) and team B (N=30). The result showed gain value of each team of creative thinking skills which were: team A (0.62) with three category: low (8%), average (40%), and high (52%). Team B (0,04) with three category: low (80%), average (10%) and high (10%).

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**Keywords:** mind map, creative thinking, biotechnology

### INTRODUCTION

Education is a process of two-way communication which teaching is done by teachers as educators while learning is done by learners. In this case, the role of the teachers are not only providing information, but also directing and accommodating the learner with educational facility therefore the teaching-learning process become more adequate (facilitator). Education as a learning process is established by the teacher to develop creative thinking which can improve the ability to think and reconstruct of the learner towards new knowledge as an effort to improve good mastery of subject (Syamsudin & Budiman, 2007). Discussing a problem in group will trigger students to cooperate, helping each other to

integrate new knowledge with their basic knowledge. (Wulandari, 2014). However, in practice the learner experience difficulties such as difficulty in concentrating and remembering, which leads to lower learning outcome. For to learn something well, we need to hear it, see it, ask question about it, and discuss it with others. In addition, the learner needs to work with it that means describing things in their own way, showing examples, practicing skill, and doing task that requires their basic knowledge. (Silberman, 2009).

The pattern of this learning process with an active teacher and passive learner has low effectiveness and cannot grow and develop active participation in the learning process (Dikti, 2008).

According to Dewey (Joyce, et al., 2009), the core of the teaching process is the arrangement of the environments within which the students can interact and study how to learn. The same thing was stated by Rutherford & Ahlgren

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(1990), the learning process of science, mathematics, and technology should take place effectively. Effective learning means learners learn how to build their own knowledge, learn through direct experience in concrete way, and learn how to solve problem in group. Teacher should be the one who is creative in classroom, not only employing the proper content but also developing the creativity of the learners in learning process. A study conducted by Temur (2012) shows that it needs an instructional model that involves students working together in groups to share ideas during the process of creative thinking.

The creativity of students and teachers are important factors that affect the learning process. This means teachers have sufficient knowledge about creativity in order to develop creativity in an appropriate manner (Trnova & Josef, 2014). In observation of the course learning biotechnology, the course learning process tends to be taught using the direct method of instruction and paper presentation. Evaluation is conducted by asking some questions on the cognitive level of C1 and C2.

On perspective of the students, they will irregularly answer the questions and find difficulties to start with it, be confused with the model/method of how to answer thus their creativity does not appear. For instance, creating answer such a diary will be looked ineffective and cause boredom to correct it. Therefore, one way to overcome that problem is applying a mind map since it can help students in summarizing the subject material they learn, so that it becomes easier to understand, in addition mind map is also a creative writing method which allows students to memorize a lot of information. According to Ramadhani, *et al.* (2015), the ability of creative thinking also can be developed with a proper method in learning process. One of the methods that can be used to develop the creative thinking ability of the students is mid map method.

Mind map method is one of the learning methods which helps students to dig into their creative ideas and be active in teaching and learning process. Mind map is a best method for teachers to improve memory and strengthen concept understanding of the student, and students also can improve their creative thinking ability. Weinstein (2014) said that learning through mind map can stimulate the visual ability of the learners. This art technique takes 10 minutes to study and can be applied in all of education aspects. For example, showing how students benefit innovative methods and creative techniques to encourage introspection, record, reflect experiences,

brainstorm, and decide goals. Mind map is a solution for classroom problems which cause sleepiness, boredom and frustration. This technique can change students, regardless their age, learning style, and ability and disability. The research question in this study is whether students can develop their creative ideas towards biotechnology material using mind map.

## METHOD

This study uses descriptive statistic. By using this method, the writer will describe or give a description about object of the study through sample data or population as it is, without making any general analysis and conclusion (Sugiyono, 2014). The research sample is six semester students of STKIP Hamzanwadi in the 2012/2013 school year. The amount are 55 students in total and divided into two major classes which are class A (N=25) and class B (N=30). Analysis of creative thinking utilizes creative thinking indicator consisting of fluency, flexibility, and originality that are connected to each other by lines. The indicators and scores are described in the table below (Table 1).

A similar mind map scoring model was also employed by Gebya & Dian (2012) by scoring in each mind map branches that are connected. The difference between the writer and Gebya & Dian is in controlled variable and scoring method for each branches which correlated in mind map model.

## RESULT AND DISCUSSION

Creativity is a complex mental activity, but it is very important for human life. To have the skills of creative thinking, one must know the basic methods of creative thinking that he really understood, so they can get interesting results. Creative thinking is an important aspect in generating new holistic knowledge and encompassing all development aspects. Creative learning strategy can help students creating new ideas and exploring area of the study deeper. Besides, with a proper technique in developing creative ideas students can also develop their skill and ability (Daud, *et al.*, 2011).

A study about the effectiveness of mind map technique in learning process was proposed by Evrekli, dkk., and Goodnough, dkk., their research finding showed that mind map provides an effective technique in improving long term memory towards factual information of science, which is 10%. The study stated that teachers en-

**Table 1.** Creative Thinking Indicators and Score using Mind Map

Indicator	Answer Criteria	Score
Fluency: Thinking fluently and creating many ideas	The answers are more than 2, related, pictures and symbols are included	5
	The answers are more than 2, related, pictures and symbols are not included	4
	Giving 2 answers, related, pictures and symbols are included	3
	Giving 2 answers, related, pictures and symbols are not included	2
	Giving 1 answer, pictures and symbols are not included	1
Flexibility: Creating new different idea or seeing from another point of view	The answer idea varies (more than 2), related, pictures and symbols are included	5
	The answer idea varies (more than 2), related, pictures and symbols are not included	4
	The answer idea varies (2 ideas), related, pictures and symbols are included	3
	The answer idea varies (2 ideas), related, pictures and symbols are not included	2
	1 ideas, pictures and symbols are not included	1
Originality: Creating unusual/never existed kind	The answer gives a new idea, related, pictures and symbols are included	5
	The answer gives a new idea, related, pictures and symbols are not included	4
	The answer gives a general idea, related, pictures and symbols are included	3
	The answer gives a general idea, related, pictures and symbols are not included	2
	The answer is wrong	1

Source: Fatmawati, Baiq. (2015)<sup>b</sup>. A Study About Student's Creative Thinking Skill Using Mind Map In Biotechnology Subject

joy the utility of mind map and technique in motivating students in science (in Mani, 2012). Learning strategy with mind map focuses more on students' active role and creative activity which will improve and strengthen their memorizing and understanding ability, and the students become more creative. Beside the teaching-learning process will be more interesting, students will also be more diligent to study and do homework, not give up easily, be fond of solving varied problems, be independent and can maintain their opinion (Pandley, *et al.*, 1994). Cathy and Azim (2013) proposed that mind map is an appropriate way towards learning observation that is constructive for technical science. Making mind map habitually in group will positively influence the quality of learning process.

The form of question on tests of creative thinking was conducted by providing a "clue" about creating a mind map. After that the mind

maps were corrected by scoring according to the pattern, and then these maps were analyzed to find N-gain for each students. This method was to determine whether the creative thinking ability of students is improving after applying the mind map method. The analysis of the answer of the students that utilizing mind mapping was conducted by finding the relationship between lines includes flexibility of expressing ideas of their mind, fluency in expressing their opinion and originality that appears in the answer, and all of which was manifested in the main map. According to the results of their pretest and posttest, there were difference scores of creative thinking in fluency, flexibility and originality.

Originality indicator showed that the students had not been able to demonstrate the originality that was proposed. The gain score was lower than either fluency or flexibility. The analysis of creative thinking ability still refers to creative

thinking indicator, but it is adapted to mind mapping principle.

The average of creative thinking value of the students had difference in experiment class and controlled class (results presented in graphical form 1). Jones (2012) with his findings showed that there is no difference in the average value of the perception among three components in mind mapping activity which is mediated socially towards the components of music model. But when forced to sort mapping, report and learning preference of the students were varies, which makes it possible to examine differences in some subgroups of students. Overall, it can be concluded that although the average rank of the three activities of mind mapping is similar, students have various beliefs in what activity and what subject they can learn. After N-gain creative thinking of both classes was determined, it was grouped into three categories of low, medium and high creative thinking ability (result is presented on the Figure 2).

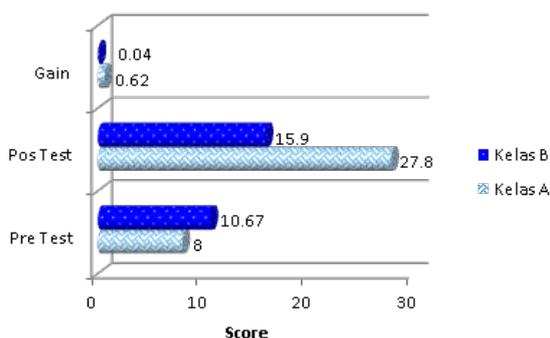


Figure 1. Creative thinking score gain using Mind Map in biotechnology subject

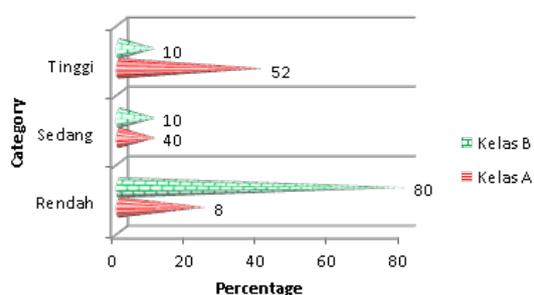


Figure 2. Creative thinking criteria using Mind Map in biotechnology subject

Figure 2 showed that class VI A gets high and medium score more dominantly than class VI B, since during the learning process, students of VI A on their spare time asking more detail about the mind map. A concept focused on the implementation of biotechnology in various field

such as food, environment, health, forestry, animal husbandry, plant breeding, mining, and biodiversity. Based on this, students were asked to describe the application of biotechnology to the fields. Gebya & Dian (2012) found that mind mapping that can fulfill all of the aspect required with percentage (41,7%) for very good, (41,7%) for good and (16,6%) for enough. Fatmawati (2015) stated that students can express and develop their ideas of mind by forming a pattern of ideas interconnected with the main topic in the middle while the sub topic and its detail are formed into its branches, using colors and pictures towards fermentation material. The result of gain value for each creative thinking indicators using mind map are fluency (1.50), flexibility (1.58), and originality (2.58).

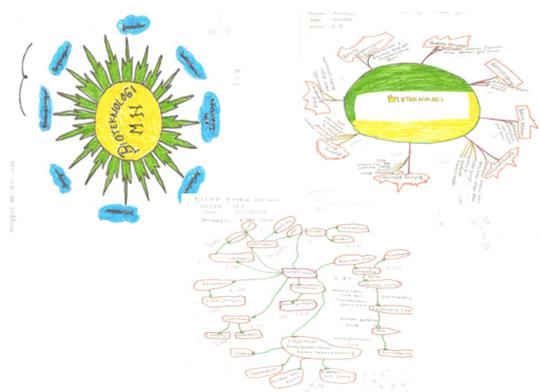
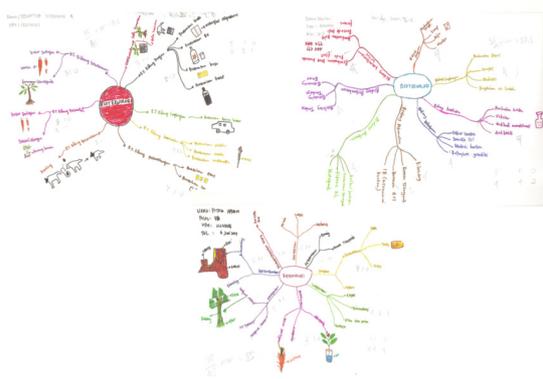


Figure 3. Examples of mind map in biotechnology course before applying the mind map technique.

Before creating a mind map, teachers provided technical illustration mind map and asked the students to find references on the internet about how to create a mind map. The students only used one or two colors to connect branches, but the desired pattern of the mind map had not been formed yet. Fatmawati (2014), according to her study about mind mapping the fermentation process in microbiology class, found that the mind map created by students before applying mind mapping method looked incomplete. It is because the students start knowing mind map in learning process, their answer are convergent and do not show any creative thinking ability.

Based on that study, the teachers asked the students about difficulties related to mind mapping. They stated that the hardest part was making the connections that relates to each other and drawing the mind map pattern and the confusion of how to start writing. After knowing the problem, teachers explained it in detail and showed the example of mind map.



**Figure 4.** Mind map in biotechnology course after understanding the mind map technique.

An effective strategy for mind mapping is explaining it in detail all possible applications of mind mapping, utilizing different colors, words and pictures and encouraging the students to use mind map in their group activity. In fact, these research findings provide a framework in spreading mind map technique to mechanical engineering students. Framework proposal tries to create a better creativity development program (Zampekakis & Tsironis, 2007). Mind map is a creative and effective way of writing, and literally will mapping the minds. Mind map is one of creative learning media that reflects how brain works. Mind map is a learning method which activates both sides of the brain and issues all of the potential and capacity of the brain that are still hidden. Mind map provides many beneficial aspect for student in studying, thinking, planning their daily activity, recording, summarizing, writing and even exploring creative thinking ability.

Figure 2 indicates that students have already understood mind mapping technique by applying symbols, pictures, and colored text to connect a series of words in the mind map. Fatmawati (2015) stated that after applying the mind mapping method, students improve their answers and develop their ideas of mind by utilizing various colors and pictures forming a pattern of ideas that are related to the main topic in the middle with subtopic and its detail as the branches. Creative thinking skill and learning achievement that learned using mind mapping method is better than creative thinking skills and learning achievement of Social students who take the conventional learning (Priantini, *et al.*, 2013). Riswanto & Pebri (2012) suggested that there is a significant difference towards the students' writing achievement which taught through mind mapping strategy. Mind mapping strategy improves students' writing achievement, most of them are more interested in writing provided topics about social

organizations and news items.

During the mind mapping process, students enjoy designing their works in form of mind map. They get pleasure. They express it like a child by drawing, but this is a way to memorize and write their creative ideas in developing the given material. a thing that should be remembered in making a mind map is not all learners can use symbols and images to clarify the meaning of the mind map, as influenced by internal factors of a person, such as "the soul of art".

Mind map helps students to learn information by making them organize and add pictures and colors. It is proven that mind map reduces the extrinsic cognitive burden since students create their own two-dimensional space to tie the related ideas and concepts (Nesbit & Adesope, 2006). Mind map allows students to make visual pictures to improve their learning (Budd, 2004) and can be used as Meta cognitive media which allows them to create a connection with material meaningfully. Ozgul (2012) stated that the application of mind mapping in learning process helps teacher to improve their teaching method, lesson plan and evaluation, and make teachers happier in teaching and learning process.

Mind map consists of a network that connects a corresponding concept, connects ideas with others. The form is free. Spontaneous thinking is needed when making a mind map, the goal of mind map is to find a link between creative ideas (Mani, 2012). Mind maps can be employed in many fields, such as those which used by Radix&Azim (2013) in technical engineering who argued mind map is a proper way to an observation of constructivist learning in knik tea science. Some of the benefits of mind map are: a) understanding the material, b) planning, c) communicating, d) being creative, e) saving time, f) resolving problem, g) concentrating, h) arranging and explaining ideas, i) memorizing, j) learning more quickly and efficiently, and k) seeing the whole picture. Mind Map aims to make the subject material patterned visually and graphically that can help to record, strengthen, and recall the information that has been learned (Buzan, 2004).

## CONCLUSION

Students are able to express their creative ideas using mind map in biotechnology class, this can be identified from gain value obtained by VI A class 0.62 with low (8%), medium (40%) and high (52%) category. While class VI B only varies in 2 points (0.04) from class A with low (80%), medium (10%) and high category (10%). Class

VI A is more active in asking/discussing outside the lecturing hours about how to make mind map. Not all learners can employ symbol, and or picture in process of mind mapping to complete their answer.

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