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# Use of butterfly house as learning media to improve creative thinking skills of pre-service biology teachers

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**Abstract.** Improved learning outcomes will be obtained whereby strengthened learning process. One of the things that must be fulfilled in, the strengthening of the learning process is through the use of contextual relevant and hands-on activity-based learning media. One of the learning media that meets the criteria is the butterfly house. The purpose of this research is to focus on how Pre Service biology teacher can improve their creative thinking skills through a series of project-driven activities that lead to fluency thinking, flexible thinking, original thinking, elaboration, and evaluation. The method used in this research is quasi-experimental pre-test-post-test design. The results showed that the ability of the pre-service Biology teacher had a significant improvement in creative thinking skills (thinking fluently, fluid, original, detailing and assessing) after following a series of project-based practicum. The category of increase (N-Gain) is 0.89 which is included in the high category. So it can be concluded that there are significant a differences in creative thinking skills consisting of fluency thinking, flexible thinking, original thinking, elaborating thinking and thinking of evaluating pre-service biology teacher students before using project-based practicum and after being given a project-based practicum.

## 1. Introduction

Skills in 21st century need to be mastered by learners to ensure the survival of future generations of Indonesia. The curriculum in Indonesia is beginning to adapt 21st century skills, that consist of critical thinking skills, creative thinking, communication and collaboration. The development of students' creative thinking skills in learning is necessary because of challenges of the future as well as increasingly fierce competition. In this era of globalization students are expected not only skilled in understanding a field of science, but also must be creative in developing the field of science. It needs to be manifested in every subject at school. The existence of the four pillars of thinking skills contained in the curriculum should be coupled with the implementation of learning that leads students to practice and learn the ability of creative thinking. The ability of students in creative thinking must of course be preceded by teachers to be able and skilled to teach and invite students through learning about critical thinking. A teacher who always teaches the content of the subject matter to his students through learning that develops creative thinking will produce creative students. Therefore, it is needed teacher candidates who have the



ability to think creatively in the future after he becomes a teacher no longer awkward how to practice teaching that develops creative way of thinking. Creative thinking encompasses a group of cognitive traits such as fluency, flexibility, and originality [1-4]. Creative thinking is known to produce ideas, solutions, concepts and theories that are characterized by uniqueness and originality [5-7]. Creative thinking results from synthesis, re-synthesis, generation and idea formulation. It produces new and surprising ideas that have not occurred to the individual before [8]. In developing the ability of creative thinking cannot be separated from the role of the media because the media will reinforce the learning process. One medium that can develop students' creative and contextual thinking skills is the butterfly house.

Butterfly House is suitable to be used in developing creative thinking ability of Biology teacher candidate student especially on Entomology subject study. For science teachers, it is important to be able to think creatively by examining scientific facts and to explore the science embedded in everyday life through creative thinking [9]. As well as science teachers, Biology teachers are also more Biology teacher candidates. This study aims to determine the extent to which the creative thinking ability of biology teacher candidates in entomology courses using the butterfly house as a medium of learning. In addition to the Butterfly, the house is also used pupa house to store pupa during the process metamorphosis take place to show in Figure 1.



**Figure 1.** Butterfly House (left), Pupa House (center), Pupa is stored in Pupa house (right). (Source: personal documentation).

Figure 1 shows that the Butterfly house is also used pupa house to store pupa during the process metamorphosis take place. Some studies suggest that the diversity of butterflies in some places in Indonesia can be used as a source of learning, one of which, according to research [10] states that the diversity of butterflies in the Batanghari River Metro City Lampung Province of Indonesia can be made as a learning resource for both students and biology students. This is due to its high diversity. Munifah research also states that the diversity of butterflies in Taman kyai Langgeng Magelang can be used as a source of learning [11]. Veltman states that butterfly displays in a zoo in the form of butterfly houses can be used as a learning resource especially to educate the public on the importance of the diversity of butterflies within the ecosystem [12]. In contrast to researchers such as Noviandi [13] revealed in his research that to facilitate the study of butterflies used animation media metamorphosis butterfly.





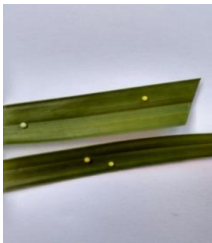







## 2. Method

The method used in this research is quasi-experiment using pre-test post-test design. Subjects in this study were seven-semester students as many as 20 people with seven men and 13 women who took Entomology courses. The use of butterfly house in Entomology course focuses on how biology teacher students can improve their creative thinking through a series of project-based practice activities that lead to the behavior of how to think smoothly, to think flexibly, to think original, to elaborate and to evaluate. Treatment process, 20 students were given a pre-test that contains four questions about the process of butterfly metamorphosis from the start of the process of laying until the process of marriage. The four questions each posed represented the behavior of creative thinking ability, one for the ability to think

fluently, one for the ability to think flexibly, one for the original thinking ability and one problem for elaboration and evaluation skills. Furthermore, the implementation of the treatment of the 20 students by giving the project task observed the process of metamorphosis of butterflies.

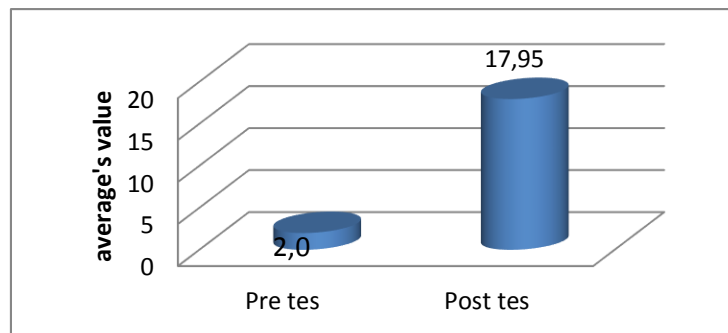
The process of conducting is done by dividing the 20 students into three groups of 6-7 members each. Each group is given a Student Activity Sheet with questions to direct students to the material content that will be studied by the students. In addition to student activity sheets are also provided with the tools and materials needed to take eggs or worms, or cocoons or butterflies they find in the garden. Tools provided are insect net, jars for temporary butterfly storage show in Figure 2, host plants and feed plants. Furthermore, after they find the eggs/caterpillars/cocoons or butterflies, the students keep them in a butterfly house/pupa or jars house depending on what they find. The results of student observation showing in table 1. Every day developments from their observations are recorded, for later reports. After approximately 45 days' observation process of butterfly, metamorphosis takes place, students are given post-test. The tests used in this study were developed from the creative thinking skills of Torrance. Torrance Test of Creative Thinking Verbal (TTCT Verbal). This test was chosen because the test is quite comprehensive measuring creative thinking skills and is widely used by researchers all over the world [14]. Many of the creative thinking skills tests that have been developed by experts include Alternate Uses, Test of Divergent Thinking & Creativity Test for Children and Torrance Test of Creative Thinking [15].

**Table 1.** Results of student observation.

Group	Name of Butterfly	Egg	Larvae	Pupa	Imago
1	<i>Graphium evemon</i>				
2	<i>Hypolimnas bolina</i>				
3	<i>Graphium Agamemnon</i>				

### 3. Result and discussion

Based on the data obtained from the results of the research, then performed analysis in the form of percentage achievement of the average score of pre-test (preliminary test), post-test (final test) and N-gain thinking ability between the experimental class and control class. Recapitulation of the research results can be seen from figure 2.



**Figure 2.** Comparison of pre test and post test values.

Figure 2 shows that the average score of preliminary test scores, final test, and N-gain is known that the average score of the initial test of students is 2 and the average score of the final test is 17.95 so descriptive data posttest is better than pretest. The category of increase (N-Gain) is 0.89 which is included in the high category. These results show in table 2, indicate that the treatment provided can improve students' ability in creative thinking.

**Table 2.** Normality test data N-Gain.

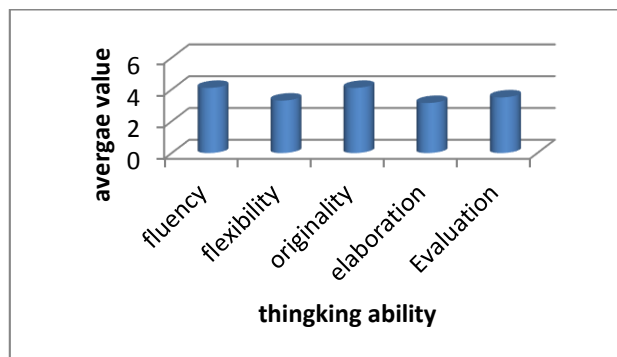
**Tests of Normality<sup>b</sup>**

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Post-test	.207	20	.024	.897	20	.037

a. Lilliefors Significance Correction

b. Pre-Test is constant. It has been omitted.

Based on the above calculation shows that the data is normally distributed, at  $p \geq 0.05$ . So it can be concluded that there is a significant difference in the creative thinking ability of biology teacher candidates to show five kinds of creative behaviors consisting of thinking fluently, thinking flexible, thinking original, thinking detailing (elaboration) and thinking rate (evaluation before using project-based practicum and after given project-based practicum treatment using a butterfly house as a medium. The average value for each thinking ability can be seen in figure 3.



**Figure 3.** The average value for each thinking ability.

Figure 3 Show the results of the data analysis show that entomologic learning using the butterfly house as a learning medium and project-based shows that there is a significant increase, despite many technical

obstacles in the butterfly preservation process. Technical constraints such as frequent eggs that have been taken from nature to experience problems such as not hatching due to death, decay, or even eaten by ants. Not to mention the weather conditions that often rains cause many eggs carried by the rain. However, from these obstacles, students get a lot of lessons and also findings so that more can explore the ability to think creatively in solving problems.

Based on the average score of preliminary test scores, the final test and N-gain note that the average score of the initial test of students is 2 and the average score of the final test is 17.95 so descriptive data post-test is better than pretest. The category of increase (N-Gain) is 0.89 which is included in the high category. These results indicate that the method can improve students' ability in creative thinking.

The dimension of creative thinking used in this study is the dimension of creative thinking developed by Torrance in [16]. The ability of creative thinking tested is the ability to think smoothly, think flexible, original thinking, thinking detailing and thinking rate. The average value for each of these capabilities varies 4.1, respectively; 3.3; 4.1; 3.15; and 3.5. Everyone has creative potential and can be improved through learning; it shows that if a person's cognitive capacities can be improved through the learning process then improving one's creative thinking ability cannot be ignored. This is by the research disclosed by Bakır and Öztekin [17] that and Thinking Levels of Science Teacher Candidates in Different Variables such as gender, school origin, grade, parental education

Questions asked to assess the ability to think smoothly is a question that is general and can be answered directly without having to learn first. An example of the question: Butterflies are unique animals, these animals only experience the perfect metamorphosis. Also, butterflies are easily recognized, and in demand by the general public, insect collectors, even scientists because of its beautiful color and have an elegant way of flying. What do you do to make a butterfly's life possible?

Questions posed for assessing the ability to think flexibly are for example Butterflies have enormous ecological importance, animals are used as an indicator of ecosystem health, which is shown by more butterflies somewhere indicating the quality of the environment is still good. *Papilio memnon* is one type of butterfly that selects Rutaceae plants (*Citrus* sp.) as a host plant to lay eggs with the purpose of the larval phase can eat the leaves on the plant in the sense of being a pest for citrus fruits. What do you do to overcome it? How to preserve butterflies and also prevent pests on citrus crops?

The question asked to assess the original or original thinking ability is that the butterfly undergoes a perfect metamorphosis through the stages of eggs, larvae (caterpillars), pupa (puppets) and imago (adult). *Papilio memnon* is one of the easiest butterflies found in the neighborhood. How to observe *Papilio memnon* metamorphosis? Draw up your observations!. Questions asked to assess thinking skills detailing (Evaluation) is Make a product of your observations about the butterfly metamorphosis (bioplastic/poster/clipping/insectarium). And write down your reasons why choose to make the product.

#### 4. Conclusion

The results showed that there was a significant improvement in the creative thinking ability of biology teacher candidates after performing project-based learning using the butterfly house as a medium of learning in Entomology courses in the high category. Thus the use of butterfly house as project-based biology learning media can improve the ability of creative thinking characterized by flexible thinking, thinking smoothly, original thinking, elaborating and evaluating and can bridge the difficulty of studying butterflies in the wild and lack of study of butterflies use animation media. This finding supports the necessity of developing pre-service Biology teachers' creative thinking skill to face the challenges of the 21st century.

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