International Journal of Biology Education Towards Sustainable Development
Vol.1, No.1, 2021, pp. 38-47
e-ISSN 2809-5073 DOI. 10.53889/ijbetsd.v1i1.51

The Effect of Biotechnology Learning using Pulau Tunda's Local Potential on Students' Creative Thinking Skills

Submitted 20 July 2021 Revised 31 December 2021 Accepted 31 December 2021

Iis Rusmiyati[1*], Siti Gia Syauqiah Fitri[1], Indah Juwita Sari [1,2]
[1]Department of Biology Education, Faculty of Teacher Training and Education,
Universitas Sultan Ageng Tirtayasa, Serang, Indonesia
[2]Division of Science Education, Faculty of Education, Kasetsart University, Bangkok, Thailand

Corresponding Email: *iisrusmiyati7@gmail.com

Abstract

This study aimed to determine the effect of learning using local potential of Pulau Tunda on the creative thinking skills of class XII students on biotechnology concept. The method used is quasi-experimental and research design used in this study is a posttest-only control design. The independent variable in this study is Biotechnology learning using local potential of Pulau Tunda while the dependent variable is the creative thinking skills. The subject in this study were students at one high school in Indonesia consists of two classes, namely class XII IPA 2 as an experimental class and XII IPA 3 as a control class. The sampling technique is done simply random sampling. Data were collected through posttest to measure students' creative thinking skills and student response questionnaires Ability results creative thinking was analyzed using the t-test. Based on those results that there is an influence of learning with the utilization of the local potential of the Pulau Tunda on students' creative thinking skills on biotechnology concept.

Keywords: Biotechnology, Local Potential, Pulau Tunda, Creative Thinking Skills

INTRODUCTION

Thinking is an activity that involves manipulating and transforming information in memory. Students think to form concepts, reason, think critically, make decisions, think creatively, and solve problems (Santrock, 2009). According to Johnson (2007), based on the development of the world of education today, students must be able to master the ability to think, especially the ability to think at a higher level to face the problems that will be faced. Higher-order thinking is divided into two, namely, critical thinking and creative thinking. One of the higher-order thinking skills that are rarely explored by teachers for mental development and changes in students' mindsets towards learning materials is creative thinking (Isnaeni et al., 2012).

Creative thinking ability is a process of mental improvement of students in remembering and understanding data, facts, and concepts to find new solutions or modifications of a problem encountered (Sanjaya, 2010). According to Isnaeni et al. (2012), creative thinking skills are needed to deal with various problems, especially in the current development of education, which is full of competition and requires human resources as reliable personnel with high quality and expertise, who are able to work. The same, high-order thinking, creative, skilled, understanding various cultures, and communicating. The aspects used to measure students' creative thinking skills, according to Munandar (2004) are fluency, flexibility, originality

(originality), and detail (elaboration). Creative thinking skills in learning can encourage students to be scientific and describe creativity in solving problems.

Based on the results of interviews with Indonesian teachers in biology, the process of learning biology in the classroom there are already about 5% of students who have creative thinking skills, which can be seen from several indicators of creative thinking abilities. However, there has never been an assessment of students' creative thinking abilities and how these students' creative thinking abilities can develop properly. According to Munandar (2012), the development of students' creative thinking skills is still getting less attention in formal education, even though creative thinking skills can develop students' potential as a whole and for the advancement of science and art and culture and in this era of development it cannot be denied that prosperity and glory society and the state depend on creative contributions, in the form of new ideas, new discoveries, and new technologies from the younger generations. Therefore, creative attitudes and behavior are needed from an early age so that students will receive knowledge and produce knowledge.

The development of students' creative thinking skills is influenced by environmental factors such as family and school, which can function as a driver in developing students' creative thinking skills. Many students have good creative thinking potential but are not supported by their environment (Munandar, 2012). Therefore, it is necessary to use a suitable environment to be used as a learning resource for students who can develop creative thinking skills. The development of creative thinking skills can be done by utilizing the environment that can be used as a source of learning, one of which is the use of local potential. The local potential is also known as regional potential. The regional potential is the potential of specific resources owned by an area (Ahmadi et al., 2012). One that can be used as a source of student learning to develop creative thinking skills is utilizing the local potential of Pulau Tunda.

Utilization of Pulau Tunda's local potential, located in Tirtayasa sub-district, Serang district, Banten province, is the use of natural resources owned by the area. One of the uses of natural resources on Pulau Tunda, namely sea animals in the form of sea cucumbers which are widely spread in the western, northern, and southern coastal areas of Pulau Tunda are usually consumed as food that has a delicious taste and is used as medicine. There is also a cassava plant in cassava peel which residents use to purify water. Various potential natural resources owned by Pulau Tunda can be used as learning resources, especially on biotechnology.

The concept of biotechnology is found in class XII in senior high school and has several learning indicators, namely, explaining the differences between conventional and modern

biotechnology and the role/application of conventional and modern biotechnology. The concept of biotechnology is an application of biological science and technology. Biotechnology learning materials study biotechnology's meaning, basic principles, and roles in science, the environment, technology, and society. Biotechnology has a very important role in improving the welfare of human life, especially in conventional and modern biotechnology applications. Through the utilization of the local potential of Pulau Tunda, students are directed to be able to find potential or natural resources as an indicator of the ability to think creatively regarding the role of biotechnology in various fields. In this study, researchers applied learning by utilizing the local potential of Tunda Island to determine the condition of the development of creative thinking skills of high school students in class XII.

METHOD

The method used in this research is quasi-experimental. The researcher looked at the effect of the X variable on Y by using a quasi-experimental method. The research design used is the posttest-only control group design. This study involved two groups, namely the experimental and control groups. The experimental group used treatment in the form of learning by utilizing the local potential of Pulau Tunda, while the control class did not use learning through the utilization of the local potential of Pulau Tunda. The two groups were not given a pretest, but a posttest was carried out after being subjected to a new treatment. The subject in this study were students in Indonesia of class XII Science 2 as the experimental class and XII Science 3 as the control class with a total of 25 students. The sampling technique in this study used simple random sampling or random samples. This technique is used because the distribution of students' abilities is even or there is no superior class. Data collection techniques using test and non-test techniques.

The test technique measures students' thinking skills by using description questions. Meanwhile, non-test techniques are used to determine the implementation of the learning process on the learning process. This non-test technique uses a student response questionnaire. The test used is a subjective test of the type of description to determine students' creative thinking skills on the concept of biotechnology. The description test used eight questions that match the indicators of creative thinking skills: fluency, flexibility, originality, and elaboration. Each indicator has specific criteria outlined in the test and is expected to appear in the student's answers. Hypothesis test analysis was conducted to determine the effect of learning by utilizing the local potential of Pulau Tunda on the

creative thinking abilities of XII grade high school students on the concept of biotechnology.

RESULTS AND DISCUSSION

The average value of creative thinking abilities of students in the experimental class is 78.2, including the creative category, and the average value of creative thinking skills in the control class is 40.4, including the category of creative enough. The students' creative thinking skills were tested by statistical tests with normality and homogeneity tests. Next, a hypothesis test was conducted using a t-test which showed an effect of learning by utilizing the local potential of Pulau Tunda on students' creative thinking skills on the concept of biotechnology.

Table 1 Statistical Test Results of Students' Creative Thinking Skills

Statistic test	Significancy		information
	Experiment	Control	
Mean	78.2	40.4	
Normality	0.097 (0.097>α)	0.2 (0.2>α)	The data is normal
Homogeneity	0,16 (0.16>α)		The data is homogene
T-test	0,005 (0,005<α)		Ha is accepted

In the experimental class, learning is carried out by utilizing the environment as a learning resource, namely through the potential local student worksheets of Pulau Tunda. This learning provides opportunities for students to gain new knowledge from the environment, thus helping them have ideas about natural resources that can be utilized in their roles in various fields of biotechnology. According to Ibrohim (2015), learning utilizes learning resources or teaching materials taken from the context of the surrounding environment or especially local resources closely related to everyday life. Students are expected to make learning more meaningful. Utilization of the environment is a learning approach that seeks to increase student involvement by using the environment as a learning resource. Through the use of this environment, it is assumed that learning activities will attract students' attention if what is learned is taken from the environment so that what is learned is related to life and is beneficial for the community (Mulyasa, 2014).

In the experimental class, which is in learning activities, the teacher delivers biotechnology material interspersed with questions/students are allowed to ask questions. In addition, the teacher explains a general description of the local potential of Pulau Tunda that can be utilized in the role of biotechnology. An overview of the local potential of Pulau Tunda is in the form of Pulau Tunda's biological resources, such as marine animals, coconut trees, breadfruit, mangroves, coconut mushrooms, etc. In addition to an overview of Pulau Tunda,

students were also shown a video of their trip to Pulau Tunda. In the core learning activity, the teacher gives student worksheets about the local potential of Pulau Tunda, which contains information about Pulau Tunda's natural resources. Students got more information about Pulau Tunda's natural resources. This learning makes students have various ideas about natural resources that can be used as the role of biotechnology. The development of student's creative thinking skills is influenced by environmental factors such as family and school, which can serve as a driving force in developing students' creative thinking skills. Therefore, the use of the right environment can be used as a learning resource for students who can develop creative thinking skills (Munandar, 2012).

The worksheets' advantages are that they have several benefits and objectives in learning, including activating students in the learning process. So that it helps students in developing concepts, trains students to discover and develop the teaching and learning process. Student worksheets can also be used as a tool for teachers and students in carrying out the teaching and learning process. They are helping students to add info about concepts and obtain notes on the material studied in carrying out learning activities. One of them is the potential local ttudent worksheets of Pulau Tunda, which contains information on biological resources, making students take an active role in teaching and learning activities. Arnyana (2006) adds that creative thinking skills can develop in using information and materials to bring up or explain it with students' original perspectives.

Learning in the control class is carried out using discussion and lecture methods. In the process of activities in the control class, students are also given an overview of the biological resources of Pulau Tunda that can be used as materials in biotechnology applications. The general description of the local potential of Pulau Tunda is marine animals, coconut trees, breadfruit, mangroves, coconut mushrooms, and so on. In the behavioral control class, the students looked less active, and most students were silent when the teacher gave questions and explanations. In addition, in the learning process, students from the control class used student worksheets, which had been used by teachers at school (it did not contain information about the biological resources of Pulau Tunda). Suyanto (2006) states that conventional worksheets are structured worksheets that can lead to boring learning for students if they are not linked to other media/contextually.

The percentage of students who have creative thinking skills based on aspects of creative thinking skills in the experimental class and control class in various categories can be seen in

Figure 1. Based on the picture, the two classes only show the value of creative thinking skills in three categories.

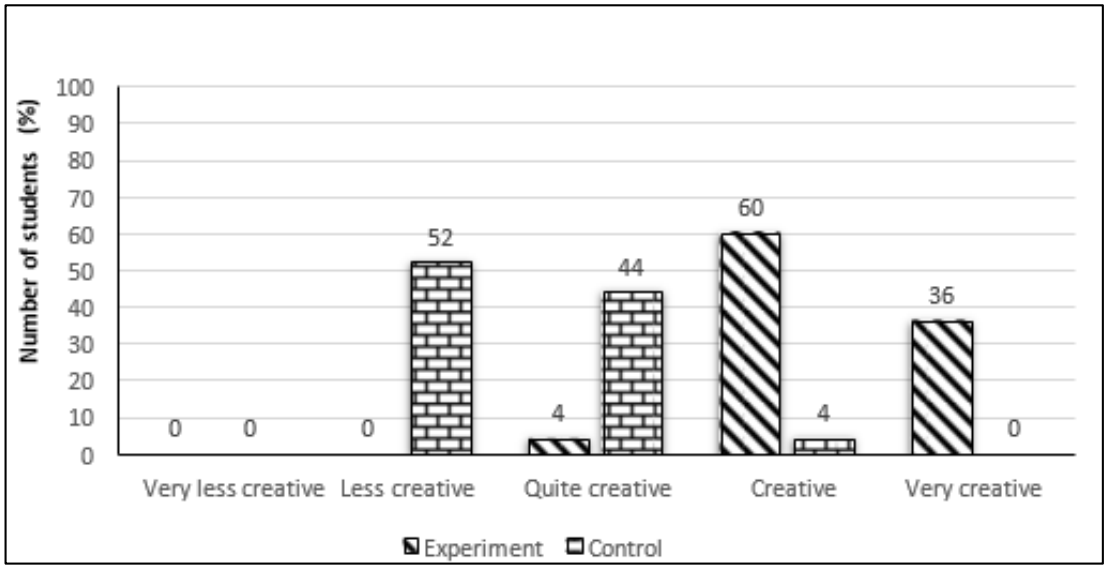

Figure 1. The number of students in creative thinking skills category between experiment and control class

In the experimental class, the category is quite creative, creative, and very creative, and in the control class, the category is less creative, quite creative, and creative. The highest category in the control class is less creative, and the lowest category in the control class is creative. While the highest category in the experimental class is creative, and the lowest category is quite creative. The difference in criteria in the two classes can be seen from students' answers and student behavior during learning. The control class dominates the less creative category, where most students in the control class tend to be passive during the learning process. The results of the description of students' thinking abilities in the control class are mostly in the range of 21-40.

The control class dominates the quite creative category. Students who fall into the category of creative enough have an average score of essay questions in the range of 41-60. The student is said to be quite creative because the student participates during the learning process in the classroom. Still, the lack of specific information about the biological resources of Pulau Tunda causes the small results obtained. The creative category belongs to both classes in the control and experimental classes. The experimental class dominates the creative category. Students who fall into this creative category have an average score of essay questions in the range of 61-80. The student is said to be creative because the student is actively asking questions and expressing opinions well during the classroom learning process. This is in line with

International Journal of Biology Education Towards Sustainable Development
Vol.1, No.1, 2021, pp. 38-47
e-ISSN 2809-5073 DOI. 10.53889/ijbetsd.v1i1.51

Munandar's statement (2012) that students are creative. Of course, some indicators cause someone to be called creative, including having great curiosity, often asking good questions, giving lots of ideas or suggestions for a problem, and being free to express opinions.

The very creative category is only owned in the experimental class. Students who are included in the very creative category have an average score of description questions in the range of 81-100. Most students who belong to the very creative category have an attitude that indicates someone is creative. These indicators include having a great curiosity and asking many questions and statements. There are four indicators of creative thinking ability: fluency, flexibility, originality, and detail. In this study, each indicator was measured in two description questions. The difference in the average value of each indicator of Creative Thinking Ability during the posttest in the control and experimental classes can be seen in Figure 2.

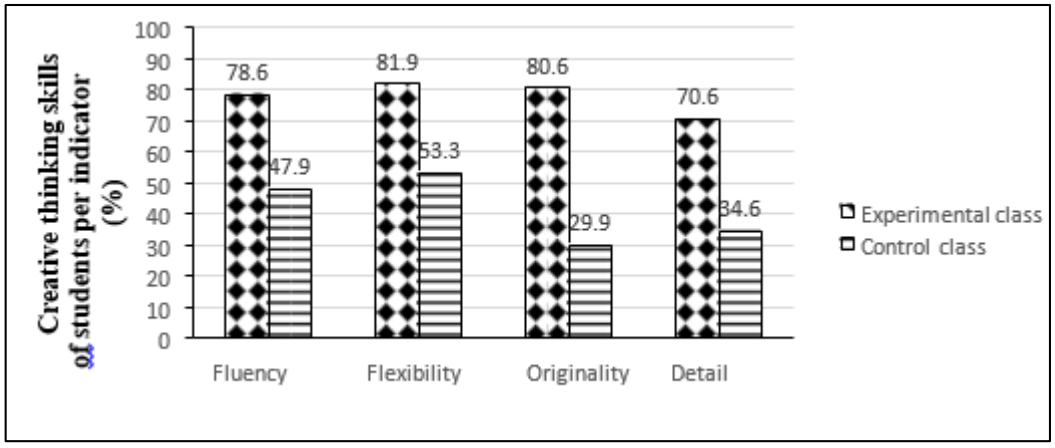

Figure 2. The percentage of creative thinking skill per indicator between experimental and control class

Based on Figure 2 shows each indicator has a different percentage of the average value. In the first indicator, namely fluency, as for the description of the ability to think fluently given is a question of creative thinking skill that utilizes the local potential of Pulau Tunda. Students are asked to describe their opinion about the natural resources of Pulau Tunda that can be used as a role for biotechnology. The question is adjusted to the fluency indicator, which is that students are expected to be able to express many statements, and the flow of thought is smooth. Following the questions posed, students are asked to state at least three opinions regarding the natural resources of Pulau Tunda using the basic principles of biotechnology.

The results show that students can describe their opinions correctly regarding the utilization of Pulau Tunda's natural resources by using the basic principles of biotechnology. This is in accordance with Munandar's statement (2012) that fluency indicators can be seen by generating many relevant ideas/answers and a smooth flow of thought. This is also reinforced

by the student response questionnaire data that students have confidence in the answers. The second indicator is flexibility. The question of the description on this flexibility indicator looks at what solutions students put forward in utilizing fallen dry leaves in the neighborhood of Pulau Tunda residents by using the basic principles of biotechnology. The results showed that the students in the experimental class answered that the dry leaves could be used as fertilizer/compost with the help of microorganisms. According to Munandar (2012: 192), indicators of flexibility include the generation of uniform ideas, being able to change methods or approaches, and being able to produce different directions of thought. This is shown in students' answers regarding their opinions on environmental problems regarding dry leaves falling in the environment around residents by using them using the basic principles of biotechnology.

The third indicator is authenticity. The percentage of the average value of the experimental class and the control class has a very significant difference. This is because many students do not answer questions about the authenticity indicator in the control class. Because the information regarding the utilization of the local potential of Pulau Tunda is not specific and only in the form of a general description in the form of Powerpoints, and students are not familiar/trained in making something new. The question of the description of the authenticity indicator is presented to see new opinions or ideas about biotechnology products with students' original thoughts. This is stated by Munandar (2012), which states that the original concept in creativity is a mental process in which individuals to create new products or ideas or combine existing products or ideas into new forms.

The last indicator details. The description questions based on the detail indicators in this study expect students to develop an idea by categorizing the use of natural resources owned by Tunda Island using the basic principles of biotechnology and making steps from an idea put forward. Most students in the experimental class answered by utilizing one of the natural resources from Tunda Island, namely coconut juice. Students categorize and explain the steps on utilizing coconut juice using the principles of biotechnology. This is in accordance with Syafi'i et al (2011) statement that details are looking for a deeper meaning to the answer or problem solving by taking detailed steps and developing or enriching an idea. Students become better at understanding and deepening biotechnology material to make students look for a deeper meaning to answers or problem solving and develop and enrich an idea.

The concept of biotechnology was chosen to see the students' creative thinking ability. Students who have good creative thinking skills will have convenience in the process of

teaching and learning activities and understand something because these students can see a problem from a different perspective from others and solve problems in new and unique ways. So that students can be responsible for solving problems and also achieve learning objectives. The concept of biotechnology also has a very important role in improving the welfare of human life, so that it is appropriate to bring up students' creative thoughts to face competition in the era of globalization.

CONCLUSION

Based on the results of this study, we conclude that there is an effect of learning by utilizing the local potential of Pulau Tunda on the creative thinking skills of class XII high school students on the concept of biotechnology with a significance value obtained is 0.005 ($0.005 < \alpha$). Based on the research results, the suggestions that will be put forward are as follows: There is a need for proper time allocation planning and preparation in carrying out learning by utilizing the local potential of Pulau Tunda, so that learning can run effectively. Researchers and teachers are expected to create active and creative learning to develop students' creative thinking skills. Learning by utilizing the local potential of Pulau Tunda can be implemented in biology learning with concepts other than Biotechnology. Learning by using the local potential of Pulau Tunda can be used to measure other thinking skills besides creative thinking skills. Learning by utilizing the local potential of Pulau Tunda can bring up new ideas for students to take advantage of the potential of the surrounding area. For further researchers, different research methods can be used by utilizing the local potential of Pulau Tunda in the form of developing learning tools.

REFERENCES

Ahmadi, I.K., S. Amri & T. Elisah. 2012. *Mengembangkan Pendidikan Berbasis Keunggulan Lokal Dalam KTSP*. Prestasi Pustaka, Jakarta

Arnyana, I.B.P. 2006. Pengaruh penerapan strategi pembelajaran inovatif pada pembelajaran biologi terhadap kemampuan berpikir kreatif siswa SMA. *Jurnal Pendidikan dan Pengajaran IKIP Negeri Singaraja* **XXXIX** (3): 495--515.

Ibrohim. 2015. Semnas Sains & Entrepreneurship II: Pengembangan Pembelajaran IPA/Biologi Berbasis Discovery/Inquiry Dan Potensi Lokal Untuk Meningkatkan Keterampilan Dan Sikap Ilmiah Serta Menumbuhkan Jiwa Kewirausahaan. http://prosiding.upgrismg.ac.id/index.php/enter2/entre_2/paper/viewFile/69 1/645, 21 Desember 2016, pk 4: 28.

Isnaeni, W., V. Anggitasari & S. Mulyani.2012. Pengaruh penerapan strategi divergent thinking terhadap kreativitas siswa. *Unnes Journal of Biology Education* **1** (2): 166--173.

Johnson, B.E. 2009. *Contextual Teaching and Learning : menjadikan kegiatan belajar mengajar mengasyikan dan bermakna.* Translated by Setiawan, I, MLC, Bandung

Mulyasa, E. 2009. *Implementasi kurikulum tingkat satuan pendidikan: Kemandirian guru dan kepala sekolah*. PT Bumi Aksara, Jakarta

Munandar, U. 2012. *Pengembangan Kreativitas Anak Berbakat*. Rineka Cipta, Jakarta.