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The Effect of Project Based Learning Model on Creative Thinking Ability in Biology Learning

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Abstract: This research aims to gain insights into the influence of the Project-based learning model on the enhancement of creative thinking skills among high school students in the subject of biology. The low creative thinking skills of high school students and the teacher-centered learning model, which typically involves lectures, have prompted the need for a more active learning process that involves students in the learning process. The Project-based learning model has been identified as a suitable approach for this purpose. To conduct the research, an expost facto method was employed, involving a review of relevant literature on the topic. The findings of the study indicate that the Project-based learning model has a positive impact on the creative thinking skills of high school students, as evidenced by an increase in the average scores of the students. This research adds to the body of knowledge on effective learning methods and has practical implications for educators seeking to enhance the creative thinking skills of their students. Further research could be conducted to explore the potential of the Project-based learning model in other subjects and at different educational levels. Additionally, it would be valuable to examine the long-term effects of the Project-based learning model on the creative thinking skills of students, as well as its potential to foster other desirable outcomes such as critical thinking and problem-solving skills.

Keywords: Project-Based Learning, Creative Thinking Ability, Biology, High School Students

INTRODUCTION

Learning is a natural part of everyday life and can occur anywhere and at any time. The purpose of learning is to shape a better individual than before. According to Djamaluddin & Wardana (2019), learning is defined as a change in an individual that includes a change in the quality of behavior towards a better direction, an increase in knowledge, skills, attitudes, and other abilities. This is also supported by the views of Suyono & Haryanto (2014) that learning is a stage of change in an individual's attitude or structure of knowledge based on certain learning or training experiences as a result of active interaction with the environment and sources around them. According to Law No. 20 of 2003 on the National Education System, education serves to develop abilities and character in order to educate the nation.

As scientific knowledge and technology advance to support the teaching and learning process, educational institutions must be able to adapt to the needs of the current era. The rapid advancement of scientific knowledge requires students to quickly adapt to change and enhance 21st century skills. According to Septikasari & Frasandi (2018), 21st century skills include critical and problem-solving thinking, creative thinking, communication skills, and collaboration skills.

With the guidance of the times and the needs of students, the learning model has also evolved from a model dominated by teachers using lectures, resulting in a one-way learning process. To involve students actively in learning, students must be actively involved in the learning process. This view is supported by the explanation of Djamaluddin & Wardana (2019) that learning using

a teacher-centered learning model will produce passive and less creative students, as seen from the response of students who are afraid to express different opinions, unlike a student-centered learning model that guides students to build knowledge from various sources and actively involves students in problem-solving.

One such model is the Project-based learning model. According to Hasan et al. (2022), this learning model can improve the creative thinking skills of students because it provides flexibility in finding solutions and enables students to independently develop their knowledge and creativity. This is supported by the statement of Chasanah et al. (2016) that this learning model emphasizes student-centeredness by actively involving students in the problem-solving process because the Project-based learning model focuses on the project process.

In the era of digitalization, the ability to think creatively is needed in all fields of science, including biology, where there are many events that must be solved creatively. According to Anggelisa & Bangun (2020), the ability to think creatively is defined as the ability to think in determining solutions and implementing problem solving in the form of projects. Dewi (2022) in her research said that there are several advantages of the project-based learning model, including providing opportunities for students to design problem-solving processes to find a result so that students are able to produce real products. Thus, students' creative thinking skills will be formed in solving problems.

Based on the results of a literature study, many high schools still apply conventional learning models in the learning process, thus providing little opportunity for students to develop their creative thinking skills in the learning process. Because learning is still centered on the teacher by applying the lecture method, the result will bring about boredom in students and affect the improvement of their creative thinking skills. In addition, the teacher-centered learning model will lead to competition between students instead of forming collaborative values within the team. As is the case with the research that has been conducted by Arhriah with the title "Creative Thinking skills of students who are taught through the Pjbl learning model and the conventional model of environmental pollution" it is found that there is an increase in the creativity of students when compared to conventional learning models. Thus a learning model is needed that can stimulate students to release their creative power in solving problems, one of the learning models is project-based learning.

Thus, the aim of this study was to gather information about the impact of the Project-based learning model on enhancing the creative thinking abilities of high school students in biology subjects. This research utilized a literature review approach by evaluating relevant articles.

METHOD

This research is a literature study that aims to investigate the influence of the Project-based learning model on the enhancement of creative thinking skills among high school students in the subject of biology. The use of the expost facto research design allows for the analysis of existing data from previous research, which can provide valuable insights into the topic being studied. The data used in this study were obtained from relevant articles on the impact of the implementation of the Project-based learning model, which were sourced from the population of all scientific articles with ISSN on this topic.

To select a sample of articles for this study, a purpose sampling technique was used, which involves selecting a sample that is specifically relevant to the research question. This approach allows for a more targeted analysis of the research topic and can provide more in-depth insights. As a result of the purpose sampling, a sample of 6 articles related to the impact of the implementation of the Project-based learning model on the creative thinking skills of students was obtained. These articles were then analyzed using a qualitative descriptive approach, which involves describing and interpreting the data in order to gain a deeper understanding of the research topic.

RESULTS AND DISCUSSION

The research results were obtained by conducting a literature study on secondary data sourced from various journals. Retrieved 6 articles that are relevant to the research being carried out. The results of the analysis can be seen in Table 1.

Table 1. Analysis of Increasing Students' Creative Thinking Ability by Applying the Project-Based Learning Model

No	Author (year)	Hypothesis testing	Research result		Remark
			Xe	Xc	
1	Ashriah et al. (2020)	-	58,23	46,70	-
2	Nita & Irwandi (2021)	0.00<0.05	79,19	-	H1 was accepted
3	Kusumaningtyas et al (2020)	0.00<0.05	87,33	75,17	H1 was accepted
4	Utami et al. (2015)	0.01<0.05	82,72	77,12	H1 was accepted
5	Orcito et al. (2021)	0.00<0.05	82,12	68,53	H1 was accepted
6	Hasan et al. (2022)	0.01<0.05	77,25	69,09	H1 was accepted

Note: Xe: The average value of the experimental class; Xc: The average value of the control class

Based on the results of the analysis of six articles that examined the impact of the Project-based learning model on the development of creative thinking skills among junior and senior high school students in biology, it was found that the average value of creative thinking abilities was higher among students in the experimental group compared to those in the control group. All of the studies included in the analysis showed a positive effect, in that the use of the Project-based learning model resulted in an increase in the average value of creative thinking skills among students. The results of the hypothesis testing for these six articles were consistent with the research question, indicating that there is a significant difference between the use of the Project-based learning model and traditional teaching methods in terms of their impact on the development of creative thinking skills among students, particularly in the subject of biology.

These findings support the effectiveness of the Project-based learning model as an approach for promoting the development of creative thinking skills among students. By providing students with the opportunity to actively engage in the learning process and work on authentic problems and challenges, the Project-based learning model can foster the development of critical thinking, problem-solving, and creativity among students. This is particularly important in the subject of biology, as the ability to think creatively and critically is essential for understanding and solving complex problems related to the natural world.

This research used the average value as a measure of the change in students' creative thinking skills. The samples used in the study included five samples at the high school level and one sample at the middle school level, and all samples showed an increase in students' creative thinking skills. The research object for all of the samples was environmental pollution, which is a problem that directly affects students and can be easily related to in the learning process. By using the Project-based learning model and focusing on this relevant and timely topic, teachers can effectively engage students and help them develop their creative thinking skills.

The use of real-world problems as the focus of Project-based learning has been shown to be an effective way to promote the development of 21st century skills, including critical thinking, problem-solving, and creativity (Barkley et al., 2014). By providing students with the opportunity to work on authentic problems and challenges, the Project-based learning model encourages students to think creatively and critically as they seek to find solutions and develop new ideas. This approach is particularly well-suited to the subject of biology, as it allows students to apply their knowledge and skills in a meaningful and relevant context.

The learning model plays a crucial role in shaping the entire learning process, from the beginning to the end. It encompasses the methods, strategies, and techniques used to guide the learning process in a systematic and organized manner. According to Helmiati (2012), the learning model is a form of planned and structured learning activity. Octavia (2020) also emphasized the

importance of implementing an appropriate learning model in order to improve the quality of learning.

The learning model has a significant impact on students' success in the learning process, both in terms of knowledge acquisition and skill development. It is essential for educators to carefully consider the learning model they choose, as it can significantly impact the effectiveness of the learning process. Research has shown that certain learning models, such as the Project-based learning model, can be particularly effective in promoting critical thinking and problem-solving skills, making them a valuable tool for educators looking to enhance student learning outcomes.

In fact the dominant model applied by schools today is the conventional or teacher centered learning model. This model tends to only transfer knowledge from the teacher to the students without seeing whether there is an increase in the creativity of the students. As is the case with research conducted by Hutasoit (2021) which states that the way to arouse students is through punishment and rewards alone, while students act as experts in conveying knowledge with certain achievement targets in a relatively short time. It is clear that this model makes students slow to develop their creativity, not to mention the lack of learning experience they get. The learning process is dominated by the lecture method. Shalay in his research explained some of the impacts of this learning model. First, students tend to only use their sense of hearing in learning so they do not foster their creative progress. Second, learning only occurs in one direction. Third, they do not recognize the differences in talents, interests, and potential of students so that uniformity occurs.

According to Sutisna et al. (2019) there are several characteristics that characterize the conventional learning model: (1) theoretical learning; (2) attitudes are built on habits; (3) educators are the only source of knowledge; (4) giving birth to students who are mechanistic; (5) giving rise to individualism. The conventional learning model is characterized by a focus on theoretical knowledge, the development of rote learning skills, and a teacher-centered approach to instruction. This model tends to emphasize the transmission of knowledge from the teacher to the student, rather than encouraging active participation and problem-solving. It often promotes the development of habits and rote learning skills, rather than encouraging critical thinking and creative problem-solving. The conventional learning model can also produce students who are mechanistic in their approach to problem-solving, focusing on following established procedures rather than thinking independently and creatively. Additionally, this model often emphasizes individual achievement and competition, rather than collaborative learning and teamwork. Overall, the conventional learning model has several key characteristics that distinguish it from other approaches to education.

One learning model that has been shown to be effective in promoting creativity among students is the project-based learning model. This model involves assigning students to complete a project, allowing them to explore various learning sources and practice their skills over a set period of time. According to research by Musta'in (2017), this approach encourages students to be active in their learning and develop their skills by tackling real-world problems. Rohmaniah et al (2021) and Winarti et al. (2022) also concur, stating that the project-based learning model is designed to stimulate creative thinking and problem-solving skills through the use of real-life scenarios. This aligns with the perspective of Yogica et al. (2020), who asserts that this model is effective in fostering creativity among students.

The project-based learning model has several characteristics that make it particularly effective in promoting creativity among students. First, it is student-centered, meaning that students are actively involved in the learning process and are given the freedom to explore and discover on their own. This allows them to develop their own interests and curiosity, leading to more innovative and creative approaches to problem-solving. Second, it is problem-based, meaning that students are given a real-world problem or challenge to solve, which encourages them to think critically and creatively in order to come up with a solution. This problem-based approach allows students to apply their knowledge and skills to authentic situations, making learning more meaningful and engaging. Finally, the project-based learning model is collaborative, allowing students to work in teams and share ideas and insights with one another. This collaboration fosters

a sense of community and helps students to develop teamwork and communication skills, which are essential for creative problem-solving. Overall, the project-based learning model offers a number of benefits that can help to enhance creativity and critical thinking skills among students.

Limitations

During the research process, several obstacles or limitations were encountered that could serve as areas for improvement in future studies. These limitations include: 1) The sample size for this study was relatively small, comprising only 6 articles, which may not accurately represent the broader population; 2) The data collected from previous research did not cover all aspects of the topic, as some studies did not include hypothesis testing or the average final score of students using the Project-based learning model. These limitations suggest that further research may be needed to more fully understand the impact of the Project-based learning model on creative thinking skills.

CONCLUSION

Based on the analysis of the articles, it can be concluded that the use of the Project-based learning model in teaching has a positive effect on the enhancement of creative thinking skills among students. This can be seen from the comparison of the average grades of classes that use Project-based learning as a teaching model. Therefore, this model can be applied in teaching. It is important to note that the Project-based learning model can be an effective approach for promoting creative thinking skills among students, as it allows for a more interactive and hands-on learning experience. By actively involving students in the problem-solving process and providing opportunities for them to work on authentic problems and challenges, teachers can foster the development of creative thinking skills in their students. However, it is also important to ensure that the learning environment is supportive and conducive to creativity, critical thinking, and collaboration. By providing the necessary resources and support, educators can effectively implement the Project-based learning model and promote the development of creative thinking skills in their students.

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