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Project-Based Learning Model to Improve Students' Creativity in Biology Learning Media Courses Biology Education Study Program, Cenderawasih University

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Abstract: The purpose of this study is to improve students' learning creativity through the application of the Project Based Learning (PjBL) learning model. This type of research is Classroom Action Research with four stages, namely planning, implementation, observation, and reflection. The research instrument uses observation sheets and learning outcome tests. Observations are carried out during learning, and learning outcome tests are given at the end of each cycle. Based on the results of the study, it was obtained in cycle 1 that the creativity indicator for fluent thinking was 37% in the less category; cycle II 60% in the good category, and cycle III 73% in the good category; then the flexible thinking indicator in cycle I was 36% in the less category, cycle II 65% in the good category, and cycle III 78% in the good category; original thinking indicator cycle I is 20% in the less category, cycle II 61% is in the good category and cycle III 75% in the good category; elaboration thinking indicator cycle I is 15% in the very less category, cycle II 57% in the sufficient category and cycle III 67% in the good category. Learning outcome data in cycle I is only 37% of students who completed, cycle II 60% of students who completed, and cycle III 78% of students who completed.

Keywords: Creativity; Project based learning (PjBL); Students' Creativity

Introduction

The concept of lifelong learning is the key to facing various challenges from the rapid changes in today's world. Moreover, 21st-century learning is now an era where world development is increasingly rapid and complex. These changes aim to improve the quality of life in modern society (Meyer & Norman, 2020; Cahya et al., 2023). In this era, human civilization is required to be able to adapt to the development of the times by answering and resolving complex challenges. This condition must be addressed as well as possible by all levels of society, including students. The rapid development of the world has negative impacts that can affect the lives of modern humans, such as moral and ethical issues and environmental pollution issues. As part of society, students must be involved in studying problems and finding solutions to phenomena that occur in nature. Thus, students need to be equipped with creativity so that they can care and respond to issues related to the impact of world development (Habib et al., 2024; Setyani et al., 2024).

Creativity is the ability to create something new so that students can provide opinions or ideas to solve problems in their application or to get other views on new relationships between pre-existing elements. Student creativity can grow when directly involved in the learning process (Li et al., 2022; Zhan et al., 2023). To bring out creativity in students, teachers in the learning process must be able to encourage students so that they can express ideas or ideas for the development of creativity through expressing opinions, asking

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questions, allowing students to speak, creating a product or work, and so on (Scott-Barrett et al., 2023; Haleem et al., 2022). Indicators of creativity are fluency, flexibility, novelty, and elaboration. It is hoped that with encouragement from teachers during the learning process in the classroom, students can interact with each other during the learning process so that an active learning atmosphere for teachers and students is created.

In learning activities, students can develop their ideas and teachers provide students with the freedom to learn to become creative students in the ongoing learning process (Maksić & Jošić, 2021; Fredagsvik, 2023). However, in practice, biology learning, especially in the biology learning media course in the Biology Education study program at Cenderawasih University, is still centered on the teacher and its implementation is still less than optimal. This causes students' creativity in their roles in the classroom to be lacking and students have little opportunity to channel their ideas. This can be seen in the initial observations made, where there were still some students who were unable to channel their ideas during discussions or when the lecturer explained. In addition, students are unable to detail material based on their analysis. This has an impact on student learning outcomes where there are 38% of students have not passed the biology learning media course (Safitri & Purnamasari, 2024; Menrisal, 2022). Therefore, it is necessary to apply a learning model that can overcome the problems above.

One of the learning models that can be applied to overcome the problems described above is Project Based Learning (PjBL) (Syahlan et al., 2023; Markula & Aksela, 2022). This model emphasizes challenging questions and complex tasks so that it encourages students to design, solve problems, organize work, and culminate in real products (Darling-Hammond et al., 2020; Ibarra-Sáiz et al., 2021). This learning model encourages students' creativity in the learning process, which will arouse the spirit of learning to get new ideas and solutions and of course, be able to solve problems in the learning process. (Winarto et al., 2022; Kiong et al., 2022). There have been many previous studies related to PjBL (Matahari et al., 2023), which of course can be used as a basis for selecting this learning model to overcome the problems in this study. Based on the previous explanation, the researcher is interested in conducting further research on a different subject, namely where the researcher teaches, especially to improve learning creativity.

Method

This type of research is Classroom Action Research (CAR) with three cycles and is carried out for two months until the Mid-Semester Exam (UTS). The subjects of the research are students who program the biology learning media course in the Biology Education study program at Cenderawasih University in the even academic year of 2022/2023, totaling 30 students. In general, this research is carried out in four stages as is customary in classroom action research, namely planning, implementation, observation, and reflection. The research instruments used are observation sheets and student learning outcome tests. Observation sheets capture student creativity during the learning process by implementing the PjBL model (Anwar et al., 2024).

Learning outcome tests are used to see the completeness of student learning in each cycle. To assess student activity and creativity, researchers are assisted by several observers through observation techniques to directly observe the learning process. The test is given at the end of each learning cycle. The data analysis technique for the observation sheet is carried out by adding up the item scores which are then presented as a percentage and the criteria will be confirmed in Table 1 scoring criteria; and learning outcome tests by calculating the number of correct answers. The indicator of the success of this research is that 70% of students completed it.

Table 1. Scoring Criteria for Student Creativity Observations During Learning

Category	Percentage (%)
Very good	≥ 81
Good	60-80
Enough	40-59
Poor	20-39
Very Poor	≤ 19

(Source: Sugiyono Modification, 2019)

Result and Discussion

Based on the characteristics of classroom action research (CAR), which is cyclical, this research was conducted in three cycles, referring to the purpose of this research, which is to improve students' learning creativity. In each cycle, four stages of CAR were carried out. In the initial stage, namely planning, the things that were done were providing teaching tools (RPS based on PjBL in the Biology Learning Media, LKM, Teaching Media, and Assessment courses) and paying attention to students' learning conditions. So that it is hoped that in the next stage, it will be more optimal; then at the implementation and observation stages, they were carried out simultaneously. The things that were done were implementing learning in the classroom by referring to the tools that had been made in the previous stage, and at the same time conducting observations and assessments. Observations were assisted by 3 observers; then at the reflection stage, namely analyzing the results

that had been obtained at the end of each cycle, this reflection aims to evaluate the success or failure of learning activities and find solutions to problems that arise during learning activities. The following will present the results of this study.

Table 2. Comparison of Student Creativity Indicators in Cycles I, II and III During Learning.

Indicators	Cycle I		Cycle II		Cycle III	
	Percentage (%)	Category	Percentage (%)	Category	Percentage (%)	Category
Fluent thinking	37	Less	60	Good	73	Good
Flexible thinking	36	Less	65	Good	78	Good
Original thinking	20	Less	61	Good	75	Good
Elaborative thinking	15	Very Less	57	Enough	67	Good

Based on the table above, it can be seen that there is an increase in each observed creativity indicator from cycle I to cycle III. The creativity indicators will be explained one by one as follows:

Fluency Thinking Ability

Fluency thinking is one of the indicators of creativity which is characterized by the ability to find ideas or concepts and can generate many ideas in solving problems, providing many ways or suggestions for doing various things. The behavior of students who have fluent thinking skills is that they provide many solutions have ideas about a problem or are fluent in expressing their ideas (Fatmawati et al., 2022; Saragih & Zuhri, 2019), on the table above, it is known that in cycle I it is in the less category with a percentage of 37%. Based on the results of the reflection carried out, it is known that in cycle I, students have not been able to express their ideas during lectures. There are still many students who are indifferent during the learning process using this PjBL model. In addition, there are still students who are not focused during lectures, the results of observations show that students are still playing with their cellphones in between learning and the most prominent thing is that there is no cooperation in groups when completing the given project.

Based on the results of the reflection, in cycle II the lecturer made improvements in learning, namely increasing motivation at the beginning of learning by showing videos that are relevant to the material and relating them to real-life experience every day. In addition, the lecturer also emphasized the form of assessment and the benefits of learning at that time. This has a real impact on student learning activities in cycle II. It can be seen that students can already express their ideas or ideas during learning. A real example is during the discussion of making a teaching aid project. Students have been able to put forward several ideas, namely by replacing expensive teaching aids with several simple teaching aids whose materials can be obtained from the student's environment. According to students, rather than using materials that are too expensive, their project prioritizes the use of materials from used materials, or cardboard that is easy to get.

In cycle II the lecturer continues to motivate students and increase monitoring during project work. PjBL prioritizes monitoring the implementation of projects worked on by students so that they do not only see the final results but prioritize the learning process while working on the Project. So, this has an impact on cycle III where 73% of students have been able to express their ideas and thoughts. It is also seen that students are increasingly fluent in asking questions or expressing their arguments or ideas. The results of this study are in line with the research of Susanti et al. (2022), which states that motivation from PjBL teachers allows students to reflect on their ideas and opinions so that their decisions are seen in the final results of student projects.

Flexibility

The second indicator of learning creativity is flexible thinking skills. Flexible thinking skills are the ability to produce new or varied answers and questions. Able to see problems from different perspectives. The behavior of students who have flexible thinking skills is being able to provide new questions or various answers to an object; and able to provide various interpretations of a story source or problem (Dwivedi et al., 2023; Knott et al., 2022). Based on Table 2 above, it is known that in cycle I, students' abilities in this indicator were still in the poor category with a percentage of 36%. However, in cycles II and III, they increased by 65% -78% each and were in the good category. The results of the reflection showed that there were still students who could not find varied answers related to the project problems they had prepared. This is because students are still fixated on their friends' answers, and have not explored their answers.

In addition, it can be seen that the PjBL syntax has not been implemented optimally, especially in the syntax of presenting, no new questions are given. The questions given are just repeat questions from the previous group. Based on this, the lecturer makes several improvements such as helping students explore

answers and questions to be more varied, and more consistent in applying the PjBL model. At this stage, the lecturer directs students, especially on the fifth syntax, namely presenting, namely by looking from several points of view based on the results displayed by the presenter group. For example, by observing the raw materials of the project results, the resulting design, and the mechanism for using the media that has been produced. Tyng et al. (2017) stated that by seeing directly and carefully observing the objects being observed and then reasoning about them, the brain will process the information observed to then be able to put forward responsive questions as part of flexible thinking. With this stimulation, students can provide varied questions and answers during presentations.

Original Thinking Skills (Originality)

Original thinking skills are the ability to produce new expressions, able to make unusual combinations of parts of the elements. The behavior of students who have original abilities is thinking about things that others have not thought of; questioning old ways and trying to think of new ways; and being able to work together to find new adjustments (Verhoef et al., 2021). Based on Table 2 above, cycle I is in the less category with a percentage of 20%, and cycles II and III increased to the good category with percentages of 61% and 75% respectively. Based on the results of the reflection carried out, the observed shortcomings were that students had not been able to innovate in cycle I.

The improvements made by the lecturer were to design better media in cycles II and III to stimulate innovative thinking. Whereas in cycle I the teacher only used PPT. Furthermore, in cycles II and III the lecturer added media in the form of learning videos combined with demonstration methods to improve students' mastery of concepts. In addition, the lecturer also increased the stimulus in terms of providing innovative ideas from their assignments. After receiving the stimulus, students were able to find innovations in their projects based on the results of group work discussions. This can be seen from the results of the projects that were worked on, many of the teaching aids produced were students' innovative thoughts.

There are 5 demonstrations developed by students made from used materials, namely animal cell demonstrations, DNA strands, kidney function mechanisms, and demonstrations for the mechanism of the food digestive system. Karunarathne et al. (2024) and Lee et al. (2023), said that original thinking is part of a person's ability to produce a product that is different from others or can be creative. A creation is the result of human thought or intelligence. In line with this study, Misbah et al. (2024), and Suryaningsih et al. (2024), also concluded that PjBL can improve students' mastery of concepts which has an impact on students' original way of thinking. With good mastery of concepts, students will be sharper in thinking and able to produce innovative works.

Elaboration Skills

The skill of elaborating is defined as being able to systematically detail something and being able to provide in-depth answers to questions. The behavior of students who have this ability is: being able to describe something in detail systematically; and being able to add suggestions that can be explained to themselves or others (Nurfuadi et al., 2023; Gomes et al., 2023). This indicator in cycle I was in the very poor category with a percentage of only 15%, and slowly increased to the sufficient category in cycle II, and cycle III was in the good category. The results of the reflection carried out showed that in the syntax of the evaluation of the results, the deficiency in cycle I was that students could not systematically explain the stages of developing teaching aids. This was because each student in the group did not have the same view, and was still based on their respective arguments. So, in cycles II and III, the lecturer made several improvements in the learning process.

The improvements made were to reinforce the concepts being studied. A real example given was stating reinforcement that a good understanding of what was being done, would have an impact on the results they obtained. Namely mastering the concept, as well as mastering the working mechanism of the teaching aids that had been made. This encourages students' learning motivation to master the concepts of the projects they develop. So that in cycles II and III students can systematically detail the projects they are working on. Both regarding design preparation and project implementation. In this case, students can detail the tools and materials used when making the project, along with their benefits, and are also able to detail the stages of project development using their language. This is in line with research conducted by Widana et al. (2022), which concluded that PjBL encourages students' learning motivation to be better and can improve students' mastery of concepts. By having good learning motivation, it will automatically provide a good understanding of the concept. So that students can think more creatively and directly help them complete the project design in their own way.

Based on the table above, it can be underlined that there is an increase in learning outcomes from cycle I to cycle III. In cycle I, only 37% or only 11 students completed their studies. Furthermore, in cycle II, it increased by 60% and 18 students completed their studies. This increase in learning outcomes increased further in cycle III, where 78% or 23 students completed their studies. This proves that the PjBL Learning model

can improve learning outcomes. This is also supported by the consistency of the continuous application of this model carried out by lecturers. In the sense that the PjBL learning syntax is carried out sequentially. So, in its application in the classroom, it becomes more focused which has a good impact on student learning outcomes. Providing integrated and focused explanations will help students be more focused on receiving the material being taught.

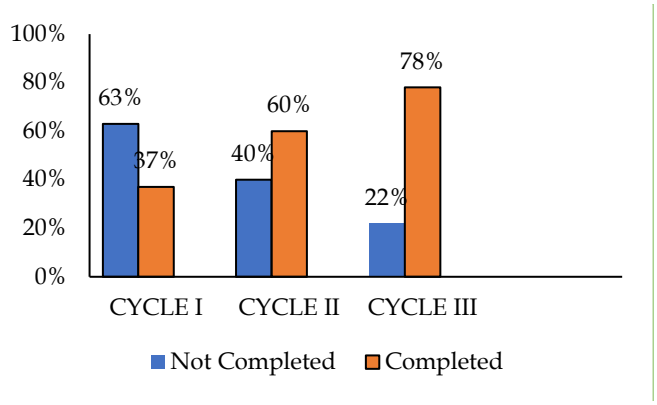

Figure 1. Comparison diagram of student learning outcomes in cycles I, II, and III

This study is in line with the research of Rahmadi et al. (2023), Nestiyarum et al. (2023), and Kusumarti et al. (2024), where the results of the study showed an increase in student learning outcomes in terms of collaboration skills, self-regulation skills, and critical thinking skills that increased. In addition Hasan (2024) and Buroidah et al. (2023) also obtained the results of the application of the PjBL model in biology lessons on growth and development material showing an increase in student learning outcomes with a predicate in cycle I being sufficient, cycle II with a predicate being good, and cycle III with a predicate being very good even though it was done online. In addition, Guo et al. (2020) Also concluded that the efforts made by teachers to improve the quality of learning and student performance through the implementation of PjBL had a positive impact.

Conclusion

Based on the results and discussions that have been carried out, it can be concluded that the PjBL Learning model can increase the learning creativity of students in the Biology Education Study Program, at Cenderawasih University. The next recommendation so that the results obtained are better, further research needs to be conducted by implementing PjBL which is integrated with learning approaches such as Contextual Teaching Learning (CTL) or with Science, Technology, Engineering, and Math (STEM).

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Author Contributions
Conceptualization, R. M.; methodology, S.; validation, I. K. M.; formal analysis, W. S.; investigation, R. M., and S.; resources, I. K. M.; data curation, W. S.: writing—original draft preparation, R. M.; writing—review and editing, S.: visualization, I. K. M. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest
The authors declare no conflict of interest.

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