

The Influence of Problem-Oriented Project-Based Learning (POPBL) on Students' Creative Thinking Skills

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ABSTRACT

Problem and project-based learning can develop students' creative thinking skills because students will learn better if they engage in meaningful learning activities. The implementation of this study uses the Problem-Oriented Project-Based Learning (POPBL) model to direct students to create creative products. This study aims to measure the effect of problem-based learning and projects on the creative thinking skills of grade X students of SMA Negeri 10 Malang. The method used in this study is quasi-experimental research using Pretest Post-test Nonequivalent Control Group Design. The results of the essay test were analyzed using the analysis of covariance (ANCOVA) test. The results showed that the application of Problem-Oriented Project-Based Learning (POPBL) had a significant effect on students' creative thinking skills. These findings suggest that problem- and project-based learning models can develop students' capacity for creative thinking skills.

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1. INTRODUCTION

In this 21st century, education is becoming increasingly important to ensure students possess learning and innovation skills, the ability to use technology and information media, and the capacity to work and survive by utilizing these skills (Arifin, 2017). The goal of 21st century education is to train and empower students' skills, preparing them to face present and future challenges (Zubaidah, 2016). Educational institutions provide quality human resources. Therefore, they face significant challenges in preparing students capable of competing in the global environment. The effectiveness of 21st century skills development through learning has been proven by various studies (Susilo et al., 2020). Teachers play a pivotal role in shaping and nurturing students' attitudes and skills to confront future problems creatively. Creative thinking denotes students' ability to generate and develop ideas to tackle issues and offer alternative solutions (Putri, 2022).

Creative thinking skills, trained in students, aim to enable them to communicate their ideas when addressing learning problems (Eragamreddy, 2013). Creative thinking skills are needed in solving problems faced by students, with teachers introducing different thoughts to students and making time for creative activities and project in class (Sari et al., 2017). These skills are characterized by the capacity to create, produce, or manifest something new through imaginative skills (Greenstein, 2012). Putri & Alberida (2022) revealed that students have low thinking skills due to infrequent implementation of interactive learning by teachers during the learning process. Utami et al. (2018) also found that students' creative thinking skills are low because the learning process is dominated by teachers, restricting students to passive roles of listening to explanations and recording presented material. Hutasoit (2021) indicated that student-centered learning inhibits students from expressing their ideas or thoughts freely, hindering the development of their creative thinking skills. The goal of training creative thinking skills in students is to enable them to effectively communicate their ideas in resolving learning-related problems (Eragamreddy, 2013).

Every student learns differently, presenting a challenge for teachers to discover methods that effectively cater to all students. The utilization of various learning models can facilitate interactive exchanges between teachers and students (Mas'ud, 2018). It is essential for educators to cultivate learning environments that enable students to relate their studies to the real world, fostering a sense of value, significance, and confidence in their

learning that can be practically applied in daily life (Nichols, 2013). Students will make strong connections between concepts and facts learned so that students actively work to find information, not just as passive learners who only receive information (Suwono et al., 2017). These encompass problem-oriented learning, project work, interdisciplinary studies, student-centered approaches, and group collaboration (Barge, 2010; Rongbutstri, 2017). Project-based learning and problem-based learning emerge as exemplary models aligned with the objectives of 21st-century education, integrating creative thinking, communication, and collaborative skills (Zubaidah, 2018).

The outcomes of research into project-based learning and problem-based learning demonstrate the benefits these methods offer for student learning (Zubaidah, 2018). Trilling and Fadel (2009) elucidate that problem- and project-based learning yield favorable outcomes in 21st-century learning and enhance various student skills. According to Latada & Kassim (2017), the implementation of problem-based learning and projects aids in providing students with valuable learning experiences, contributing to the enhancement of their skills. Woods (2014) also contends that problem- and project-based learning result in a shift in the teacher's role, transitioning from being a knowledge provider to becoming a facilitator in students' knowledge acquisition process. A high-quality education empowers students with higher order thinking skills that allow students to develop an ability to produce ideas dan to solve problems in learning (Mahanal et al., 2019). The Problem-Oriented Project-Based Learning (POPBL) model integrates problem-oriented learning, project work, and collaborative group learning aimed at problem-solving (Rongbutstri, 2017).

Problem and project-oriented learning are versatile and can be applied across various school subjects, including biology (Sari, 2023). Biology learning aims to provide a unique experience for students to engage in scientific activities. Additionally, biology learning plays an essential role in developing students' competencies (Ibrohim et al., 2022). Biology is the study of living organisms aimed at understanding life in its natural environment. This scientific discipline instills values such as curiosity, cooperation, respect for diverse perspectives, and an openness to new phenomena (Darmawan et al., 2021). Building upon this context, this research aims to assess the influence of the Problem-Oriented Project-Based Learning model (POPBL) on the development of creative thinking skills among grade X students studying biology at SMA Negeri 10 Malang.

2. RESEARCH METHOD

The type of research used is quasi-experimental research with a quantitative approach. Quasi experiment is a study that provides treatment on independent variables to determine their effect on dependent variables, but influential variables cannot be tightly controlled (Abraham & Supriyati, 2022). The research design used was pretest-posttest non-equivalent control group design (Table 1). The study was conducted from August to November 2023 on grade X students of SMA Negeri 10 Malang. The number of samples in this study was 70 students. The sampling technique uses random sampling to select 2 equivalent classes. Research instruments on creative thinking skills in the form of description problems using indicators adapted and modified from Treffinger (2002). Description questions at the beginning (pre-test) and end (post-test) of the study. The test instruments used have been tested for validity and reliability with valid and reliable results. The data collection technique used pretest-posttest scores of creative thinking skills which were tested using the One Way Ancova test at a significant level of 5%. This research consisted of 2 groups, the experimental class was given treatment in the form of a Problem-Oriented Project-Based Learning (POPBL) model and the control class were given treatment in the form of a Problem Based Learning (PBL) model. The subject matter used in this study is virus and biotechnology.

Table 1. Research Design

Group	Pretest	Learning Model	Posttest
X ₁	O ₁	POPBL	O ₂
X ₂	O ₃	PBL	O ₄

Notes:

O₁, O₃ : Pretest

O₂, O₄ : Posttest

X₁ : Experiment class

X₂ : Control class

3. RESULT AND DISCUSSION

Test the normality of students' creative thinking skills using the Kolmogorov-Smirnov test. Normality test results based on table 2 shows that the significance score for the pre-test on creative thinking skills is $0.058 > 0.05$, which means that the data on creative thinking skills has been distributed normally. The post-test significance value on creative thinking skills was $0.090 > 0.05$ which means that the data on creative thinking skills has been normally distributed. The data homogeneity test was performed using Levene's Test of Equality of Error Variances. The homogeneity test results based on table 2 show that the significance value for the post-test on creative thinking skills is $0.452 > 0.05$, which means that creative thinking skills have been homogeneously

distributed. The results of the homogeneity test show that the data on creative thinking skills between one class and another class are homogeneous.

Table 2. Prerequisite Test

Variable	Test Type	N	P	alpha	Information	
Creative Thinking Skills	Normalities	Pretest	70	0.058	0.05	Normal
	Normalities	Posttest	70	0.090	0.05	Normal
	Homogenitas	Posttest	70	0.452	0.05	Homogeny

The research data measured based on the dependent variable, namely creative thinking skills, have met the prerequisite test so that they can continue to test the hypothesis analyzed using the One-Way Ancova test with the help of SPSS. The results of Ancova's data analysis which has a treatment significance value for the learning model are $p = 0.000 < \alpha = 0.05$. These results show that there are significant differences in creative thinking skills between one class and another. The results of the statistical test of the corrected average score, from the influence of the learning model on students' creative thinking skills learned in two classes, namely the experimental class (POPBL) and the control class (PBL) are listed in the table 3.

Table 3. The Result of Ancova on the Creative Thinking Skills of Senior High School 10 Malang

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2600.734 ^a	2	1300.367	27.962	.000
Intercept	35136.930	1	35136.930	755.548	.000
PreKBK	349.177	1	349.177	7.508	.008
Treatment	1722.572	1	1722.572	37.040	.000
Error	3115.851	67	46.505		
Total	327631.000	70			
Corrected Total	5716.586	69			

Based on the table 4 the results of research data analysis using the One Way Ancova test obtained that the significance value was $p\text{-value} < 0.05$ which shows that there is an influence between the POPBL learning model on creative thinking skills in Biology material of Senior High School 10 Malang students. Moreover, based on the Table 4 The results of the LSD post hoc test on creative thinking skills showed that there was a difference in average scores between classes taught using the POPBL learning model and classes taught using the PBL model. The highest average score was obtained in the experimental class while the lowest average score was obtained in the control class. In addition, the average scores in the initial test and the final test were different, which was obtained that there was an increase in the average score in both classes and the highest increase was obtained in the experimental class.

Table 4. Post Hoc LSD Test Results Creative Thinking Skills

Class	Pretest		Posttest	
	Mean	SD	Mean	SD
Experiment (POPBL)	36.4286	13.42580	73.4857	6.48696
Control (PBL)	30.0000	12.66073	62.1429	7.73511

The implementation of the POPBL model in the experimental class serves as a facilitator for students to harness their ideas towards generating innovative solutions to encountered problems, thereby fostering the enhancement of their creative thinking skills. Every phase within the POPBL model aims to cultivates students' capacity for individual and collaborative creative thinking, commencing from problem orientation, problem formulation, project design, and project implementation.

The first phase of the POPBL model is problem orientation and formulation. Students are asked to identify problems that exist in the news in the LKPD that have been presented by the teacher. Students in groups look at the articles given by the teacher about issues or problems related to the virus in Indonesia to find questions or problems. From the questions that arise, students choose or determine contextual problems to be the theme of the project. Students will conduct discussions to formulate questions based on problems found from reading or examining the news. The activities of students looking at the news and then making problem formulations involve focusing their thoughts on an essential problem that is believed so that it can connect various known

understandings to produce various ideas or ideas. Setiawati (2018) states that the news presented in LKPD brings real situations into learning, thus requiring students to understand the problems that occur with the knowledge that students have learned.

The second phase of the POPBL model is to organize students to learn. Students individually or in groups will learn concepts related to material related to problems that have previously been found. Students explore knowledge to understand virus-related concepts through various learning resources (reading handouts, textbooks, finding information from various sources including the internet) and writing down the results in the form of summaries or concept maps. Students also explore various information related to problems or virus issues through various sources (reading handouts, textbooks, looking for information from various sources including the internet) and write down important information in the form of bullet points. Organizing students to learn is intended so that students can relate issues or problems found with virus subject matter, so that students can connect various knowledge possessed so that they can produce new solutions in solving problems. Students will reconstruct their knowledge after understanding the concept of the subject matter through various sources to solve problems that become student projects (Sari, 2023). This is in accordance with the opinion of Alfi, *et al* (2016) that learning will be more effective if it provides opportunities for students to think actively, thus encouraging students to build their own knowledge. Learning becomes meaningful through students considering the interpretation of the facts of the problem found (Sari, 2023).

The third phase of the POPBL model is designing and executing the project. Based on the virus material that has been studied by students and information that has been collected related to virus issues or problems in Indonesia, students discuss and formulate solution ideas to overcome or prevent virus problems in Indonesia. This phase deals with improving creative thinking skills that train students to be able to create and assign several varied ideas to solve problems. Students are allowed to take notes, record knowledge, and opinions to develop better ideas. This phase also provides an opportunity for students to develop ideas from various points of view as well as develop them into project themes. Students create a project plan that is carried out as a way to find solutions to the problems each group finds. In groups, students discuss to prepare a virus-related project plan which includes the title, goals and objectives, methods or ways of working, and expected results (project or action plan). Sari (2023) said that a carefully planned POPBL model in learning can improve students' analytical and reasoning skills in solving problems. Students' creative thinking skills are highly empowered with the stages of designing and implementing projects because it involves making ideas or ideas from various points of view and students can detail ideas or ideas from various points of view and students can detail ideas or ideas that are in accordance with the problems that have been formulated before being poured into the form of projects.

The fourth phase of the POPBL model is to present and evaluate project results. Together with groups of students present the results of their projects in various forms of creativity (posters, educational videos, action plans, etc.) in turns according to the teacher's direction. Students can also make reports on project results and reflections of the process of working on projects in the form of Power Points that will be presented by each group. During the reciting or presentation group, an evaluation is carried out by the teacher together with students from other groups. Some aspects asked are the reasons or basis for choosing solution ideas, the advantages and disadvantages of the product, the difficulties or obstacles faced, and solutions to improve the product in the future. Project result presentation activities are also accompanied by evaluation of project results. Evaluation aims to make improvements to projects that have been made and reflection of the project work process (Antika, 2017). Experience gained in working on projects, students get new knowledge that is constructed into solutions in overcoming a problem.

The results of the creative thinking skills test in the control class using the PBL model obtained that the results were still low. This is explained from the observations that have been made, the problem-based learning used includes several stages, namely orientation to a contextual problem related to the material then after students formulate questions or problems, the teacher directs students to work on LKPD to obtain answers to the formulated problems and learn other concepts related to the material then students are instructed in groups to discuss related The concepts in the material are then presented alternately until the subject matter has all been conveyed. This shows that there are different stages carried out, where in the control class that uses the PBL model students are trained in creative thinking when formulating problems then students only rely on handouts or other learning resources in doing questions at LKPD. Haris & Baihaqi (2022) said that students' thinking skills are still low if the solutions made by students are still not right. Arini (2017) also said that students' creative thinking skills are low because students have not been able to give different answers from other students and only provide one solution. On the other hand, students have also not been facilitated in making a simple project so that it results in creative thinking skills have not been empowered in the control class.

Based on the discussion above, that each stage of the POPBL model can facilitate students to think creatively in finding or searching, collecting, designing, and using ideas or ideas in making products that can solve problems because the POPBL learning process aims to find solutions through knowledge with project-based learning that students do so that it has an impact on learning change for the better.

4. CONCLUSION

Based on the results of this study, the Problem-Oriented Project-Based Learning (POPBL) model can improve students' creative thinking skills on virus and biotechnology learning materials. This is shown by the pretest and posttest results which show that problem-based learning models and projects can improve the creative thinking skills of grade X students of SMA Negeri 10 Malang.

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