Jurnal Arjuna : Publikasi Ilmu Pendidikan, Bahasa dan Matematika
Volume. 2 No. 2 April 2024
e-ISSN : 3021-8136, p-ISSN : 3021-8144, Hal. 243-250
DOI: https://doi.org/10.61132/arjuna.v2i2.680

The Influence of the PjBL Learning Model on the Biology Learning Outcomes of Class X Students at SMA Negeri 2 Tondano

[1] Atris Diana Kabaena , [2] Jemmy L. Sumakul , [3] Ferny M. Tumbel ,
[1-3] Jurusan Biologi, FMIPAK, Universitas Negeri Manado, Indonesia

Author correspondence : kabaenadiana200@gmail.com

Abstract. *This study seeks to examine the disparity in mean scores between students instructed through the project-based learning approach and those taught using conventional learning methods. The study population consisted of randomly selected class X pupils from SMA Negeri 2 Tondano, who were divided into control and experimental groups. The experimental class consisted of 25 students who received instruction using the project-based learning model, while the control class consisted of 22 students who received instruction using the conventional paradigm. Data collection was conducted by administering a pre-test prior to administering the treatment, followed by a post-test after the treatment was provided. The research yielded an average post-test score of 0.0842 for the experimental class and 0.075 for the control class. Statistical tests, specifically the t-test, were conducted to compare the learning results of the experimental class and the control class. The calculated* t_{count} *17.164176, was found to be more than the critical* t_{table} *1.67943. Therefore, the null hypothesis (*H_0*) is rejected. The null hypothesis* H_0 *is rejected at a significance level of 0.05. Therefore, it may be inferred that the project-based learning paradigm has an impact on students' learning results in the subject of growth substance.*

Keywords*: Project Based Learning, Student Learning Outcomes, Growth Subtance*

INTRODUCTION

Education is a very important thing because education is one of the efforts that must be made to develop one's potential and abilities; through education, a person can improve his or her quality of life (Nurrita, 2018; Domu & Mangelep, 2023). Kemendikbudristek, Decree BSKAP No. 003 of 2022, explains that ideal learning is a teaching and learning process that is not only focused on the results achieved but also how learning can provide good understanding, intelligence, perseverance, opportunity, and quality and can provide behavioral changes and apply them. in student life.

Learning is part of a person's process of gaining knowledge that can improve behavior change (Ernata, Y 2017; Nugraha, 2018; Domu et al., 2023). The learning process at school, part of the learning activities, is required to enable students to understand concepts and meanings better and more easily. Therefore, every material studied needs to have a simple structure and presentation. Learning also needs to be able to develop a capacity that is by the learning objectives to be achieved (Ananda & Fadhilaturrahmi, 2018; Pane & Darwis Dasopang, 2017; Sundari & Fauziati, 2021; Lohonauman et al., 2023). The hope of implementing a learning activity is that it can help students understand concepts, not just remember isolated facts (Mangelep, 2013; Izza et al., 2020; Lazwardi, 2017).

Biology is a discipline that prioritizes the comprehension of concepts. Biology is a scientific discipline that focuses on the study of living organisms and their surroundings (Mangelep, 2015; Tammu, 2018; Khoirudin, 2019). Biology often involves the memorization

Received Januari 30, 2024; Accepted Februari 10, 2024; Published April 31, 2024
* Atris Diana Kabaena , kabaenadiana200@gmail.com

of information (Mangelep, 2017; Suryanti et al., 2019). Consequently, it can impede pupils' comprehension of biology education. The reason for this is that studying biology entails more than simply memorizing various parts; it involves comprehending underlying concepts (Mangelep, 2017; Yusup, 2018). According to the literature, the process of learning biology involves understanding both tangible scientific facts and abstract notions (Rahmadani et al., 2017; Pratiwi et al., 2019; Aisyiyah & Amrizal, 2020; Mangelep et al., 2023). Each notion within the material serves as the foundation for comprehending each researched material. Students who struggle with studying biology may find it challenging due to the presence of intricate concepts and terminology. However, the field of biology encourages students to develop a comprehensive understanding that spans from the microscopic to the macroscopic size (Noviati, 2020; Tamba et al., 2020; Mangelep et al., 2023). Studying biology at school helps students develop and apply both theoretical and practical knowledge to solve difficulties (Aqil, 2017; Aripin, 2018; Mangelep, 2023).

Mudlofir (2017) asserts that the project-based learning model fosters increased student engagement and enthusiasm in the learning process. They will acquire knowledge and skills through the learning process. By adopting this approach, the process of learning will become more significant, leading to enhanced student learning results. According to Wijayanto et al. (2017), the implementation of the project-based learning (PJBL) paradigm resulted in enhanced student learning outcomes, particularly in the cognitive domain. The improvement percentage increased from 56.62% to 82.60%. Nurdyansah and Eni (2016) explained that students as subjects must be directly involved in building knowledge by working alone to solve problems, realize their ideas, and try to fulfill all their needs. Insyasiska (2017) stated that the lack of total student involvement in learning is because students need to make more effort to find information, reducing the meaning of active and effective learning. The project-based learning (PJBL) model begins by exposing students to a problem to be studied so that the material deemed suitable for study with this model is growth substances. There are many things that students can study through growth material to increase their active thinking.

Based on the results of observations made at SMA Negeri 2 Tondano, the learning process carried out by teachers in class has yet to empower students' learning abilities fully. Where the learning process carried out by teachers is still conventional, the learning material still tends to use the lecture method, and the learning models used are also less varied, so most students feel bored when taking part in class learning. Some students rarely participate in class learning, even during the learning process; many students need to be more serious about receiving the material provided by the teacher. This can be seen in some students who often

talk in class, some like to play games, some even often ask permission to leave during the learning process, and when asked questions related to the material that has been explained, some students only sit still unable to answer the questions given by the teacher. Students who are less active in learning will certainly hurt student learning outcomes. Students will need help in achieving the KKM score.

Despite the teacher's attempts to engage students in active learning through classroom questioning, the actual learning model employed by the teacher remains limited and heavily reliant on direct instruction, with the teacher maintaining control over the learning process. The curriculum presented to students lacks relevance to their everyday experiences; the instructor only offers occasional chances or designates a select few students to pose inquiries, and subsequently proceeds with the lecture. This results in selective student engagement during classroom instruction, with a majority of students experiencing disinterest in the learning process. In response to the challenges encountered in the learning process mentioned earlier, academics are keen on implementing project-based learning as a method to observe the progress of student learning outcomes during the learning process.

METHOD

The utilized research design is Quasi-Experimental Design. This experimental design is an advancement of true experimental design. This design incorporates a control group; however, it does not effectively mitigate the impact of external variables that may influence the execution of the experiment (Sugiyono).

The research used a Non-equivalent Control Group methodology, which is a type of Quasi-experimental methodology. This approach closely resembles the pretest-posttest control group design, with the only difference being that, in this research design, the experimental and control classes are selected randomly (Sugiyono, 2011; Runtu et al., 2023).

This study employed two distinct groups, specifically, the experimental group and the control group. The experimental class will receive therapy using a project-based learning model, whereas the control class will be treated using a traditional learning model. The mean score of the posttest in the experimental and control courses will be compared to see if there is a statistically significant difference in learning improvement between the two classes.

Table 1. Quasi Experimental Design

O1	x	O2
O3	-	O4

Information:

X: Treatment using the project-based learning (PJBL) learning model
O1: Experimental group pretest
O2: Experimental group posttest
O3: Control group pretest
O4: control group posttest

As stated by Sugiyono (2017), population refers to a broad category of items or persons that possess specific features and characteristics, which are identified by researchers for the purpose of study and drawing conclusions. The research sample consisted of pupils enrolled at SMA Negeri 2 Tondano.

RESULT AND DISCUSSION

This research was carried out at SMA Negeri 2 Tondano, applying project-based learning and conventional learning models. Class X, IPA I is an experimental class with the number of students taking the pre-test and post-test is 25 students and class Data from the pre-test and post-test of the experimental class can be seen in full in Table 2 below.

1. Research Data on Learning Outcomes of Experimental Class Students

Table 2. Summary of Pre-test and Post-Test Data for Experimental Class

No.	**Statistic**	**Statistic Value**	
		Pre-test	**Post-test**
1	Minimum Score	33	80
2	Maximum Score	40	90
3	Total	867	2.105
4	Average	36,68	0.0842
5	Standard Deviation	4.180551	3.730505
6	Variance	17.47667	13.9166

Based on Table 2 above, it can be seen that the pre-test score in the experimental class before the project-based learning model was implemented had a minimum score of 30, a maximum score of 40, and a total of 867, with an average of 34.68. There has been an increase in student learning outcomes after implementing the model. Project-based learning can be seen from the post-test scores, with a minimum score of 80, a maximum score of 90, and a total of 2,105, with an average of 0.0842.

2. Research1Data on Control Class Student Learning Outcomes

Table 3. Summary of Pre-test and Post-Test Data for Control Class

No	Statistic	Statistic Value	
		Pre-test	Post-test
1	Minimum Score	20	60
2	Maximum Score	50	90
3	Total	870	1.650
4	Average	39.5455	0.075
5	Standard Deviation	10.90097	10.5785
6	Variance	118.8312	111.9048

Based on Table 3 above, it can be seen that the pre-test results in the control class with a minimum score of 20, a maximum score of 50, and a total of 870 with an average of 39.5455 have increased. This can be seen from the post-test results, which had a minimum score of 60, a maximum score of 90, and a total of 1,650 with an average of 0.075.

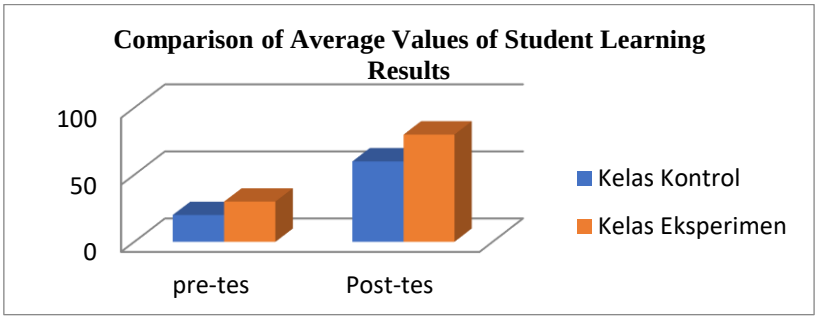

Figure 1. Comparison graph of the average learning outcomes of control and experimental class students

According to the graph, the pre-test scores of the control class and the experimental class show a relatively small average difference. This is because the distribution of student learning outcomes in both classes is similar, and no intervention has been applied to either class. Following the administration of a post-test to both the experimental and control classes, it was seen that both classes exhibited a rise in performance. Nevertheless, the experimental class exhibited a more substantial augmentation in comparison to the control class.

3. Test Prerequisites

a. Data Normality Test Results

Based on the results of the normality test, the pre-test scores in the experimental class showed a value of L_{count} 0.133 = ≤ L_{table} = 0.172. So the post-test scores for the experimental class were declared to be normally distributed. And the results of the normality test of the pre-test scores in the control class showed a value of L_{count} = 0.0689 ≤ L_{table} = 0.184, so the post-test scores for the control class were also declared to be normally distributed.

b. Homogeneity of Variance1Test

Based1on the results1of the post-test data1in the experimental1class and control class with a significance1level of 0.05, the value Fcount ≤ Ftable. The F (calculated) value obtained is 0.124362 while the Ftable value is 2.01, thus it can be concluded that the data from the two classes is homogeneously distributed.

c. Hypothesis1testing

Based1on the results of1post-test data hypothesis testing in1both classes, namely1the control class1and the experimental class, because tcount 17.164179 ≥ ttable 1.67943 so H01is rejected, H11is accepted. Thus1it can be concluded1that learning using the project-based learning model

has1a positive effect1on the learning1outcomes of1class X Sciencestudents at SMA1Negeri 21Tondano.

CONCLUSION

Based on the data analysis above, the learning process taught using the Project Based Learning (PJBL) model is a learning process that can influence the biology learning outcomes of class X students at SMA Negeri 2 Tondano. This can be seen from the average pre-test and post-test scores of the two classes, namely the experimental class with an average pre-test score of 34.68 and the control class with an average pre-test score of 39.5455. After carrying out the post-test, both the experimental and control classes experienced an increase. However, the experimental class experienced a more significant increase than the control class. This can be seen from the post-test value for the experimental class, which is 0.0842, while the control class is 0.075.

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