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The Effect of the PJBL Model in Biology Learning on the Learning Outcomes of UPTD SMAN 1 Sarudu Students

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ABSTRACT: The research seeks to elucidate the impact of the PJBL (project based learning) learning paradigm on student academic performance at UPTD SMA Negeri 1 Sarudu. This research utilizes a quantitative approach, specifically the quasi-experimental method. The population in this study comprises class X pupils, whereas the sample consists of students from classes Xa and Xb, utilizing a saturation sampling strategy. Data gathering methodologies include pretest and posttest inquiries throughout the first and final sessions. The research shows that the PJBL learning model has a big effect on how well students learn at UPTD SMA Negeri 1 Sarudu. There is a big difference between the experimental class that gets PJBL and the control class that doesn't. The Mann-Whitney test revealed a score of 1,174 for the experimental class and 779 for the control class, with a significant value of 0.005, indicating acceptance of the hypothesis. Therefore, we concluded that the PJBL learning model had an influence on the biology learning outcomes of students at UPTD SMA Negeri 1 Sarudu.

KEYWORDS: PJBL model, project based learning, learning outcomes, biology learning.

INTRODUCTION

Education facilitates pupils' self-development. It directs the potential of abilities and personal attributes towards a more positive path. The implementation of the PJBL paradigm in the teaching and learning process can enhance student learning results. Student learning outcomes are the results of students' accomplishments attained during a specific timeframe.

The project-based learning style enables students to conceive a problem and devise their own solution. The project-based learning model offers distinct advantages, including enabling students to design processes for achieving outcomes, fostering responsibility in information management during projects, and culminating in the production of tangible results that learners present in class. (Amirudin et al., 2021).

The execution of project-based learning (PjBL) is a key initiative within the independent curriculum, providing pertinent and engaging educational experiences (Dewi, 2022; Ministry of Education and Culture, 2022; Pertiwi et al., 2022), leading to its widespread adoption by educators.

Learning outcomes represent the degree of student achievement quantified by scores derived from assessments related to specific subject matter (Turns et al., 2021). Teachers use learning outcomes to gauge how well pupils understand the content they are teaching. Juhariah (2019) categorizes learning outcomes into three dimensions: cognitive, affective, and psychomotor.

The information is based on observations and interviews conducted with biology educators at UPTD SMA Negeri 1 Sarudu, located in Sarudu District, Pasangkayu Regency, West Sulawesi Province. The learning process remains predominantly teacher-centered, resulting in students adopting a more passive role. The limited application of diverse instructional models adversely affects student learning outcomes, leading to discrepancies in performance, with some students failing to achieve the minimum competency score (75) in biology.

The result is below-average student learning outcomes, especially in class X. The PJBL learning model has not yet been implemented at UPTD SMA Negeri 1 Sarudu, making the implementation of a project-based learning model essential. This approach serves as a viable solution for enhancing student learning outcomes and rendering the educational experience more fun. Project-based learning is an educational model that enables teachers to facilitate classroom learning through project work. This approach enhances student learning outcomes, fosters active collaboration among students, and mitigates feelings of boredom during the educational process.

The aforementioned issues lay the foundation for inadequate student learning results and diminished student motivation. This research is titled "The Influence of the PJBL Model on Biology Learning Outcomes of Class X Students at UPTD SMA Negeri 1 Sarudu."

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METHOD

This research employs a quantitative approach utilizing the quasi-experimental method. Sugiyono (2017) describes quasi-experimental research, which involves an experimental group and a control group subjected to distinct treatments. This study attempts to ascertain the impact of the PJBL model on the learning outcomes of tenth-grade students at UPTD SMAN 1 Sarudu. The research used is a non-randomized pretest-posttest control group design (Sudjana and Ibrahim, 2012). The subsequent table illustrates this.

Table 3.1 ***Non randomized pretest-posttest control group design***

Group	*Pre-test*	Treatment	*Pos-test*
A (Ex. Experiment)	Y1	X1	Y2
B (Kel. Control	Y1	X2	Y2

Information:
X1 : Experiment class using *PJBL*
X2 : the Control class does not use *PJBL*
Y1 : The initial test has not received the learning process
Y2 : Learning outcome test

RESULTS AND DISCUSSIONS

Descriptive statistical analysis is valuable for elucidating and characterizing research data, encompassing the data volume, maximum value, minimum value, mean value, and other relevant metrics. Table 4.5 presents the preliminary test data findings.

Table 4.5 Initial Test Data on Student Learning Outcomes of Experimental and Control Classes

Size Type	**Initial Test**	
	Control Classes	**Experimental Classes**
Number of samples	31	31
Minimum Score	5	8
Nili Maximum Score	47	64
Average Score	30.94	41.26
Standard Deviation	11.770	15.321

Source: *SPSS 25 Analysis Results*

The minimum value for the control class is 5, while the experimental class has a minimum value of 8. The highest value for the control class is 47, and for the experimental class, it is 64. The average value for the control class is 30.94, but the experimental class has an average value of 41.26. Table 4.6 presents the conclusive test findings.

Table 4.6 Final Test Data on Student Learning Outcomes of Experimental and Control Classes

Size Type	**Initial Test**	
	Control Classes	**Experimental Classes**
Number of samples	31	31
Minimum Score	50	70
Nili Maximum Score	98	98
Average Score	77.13	83.90
Standard Deviation	10.151	7.683

Source: *SPSS 25 Analysis Results*

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According to the conducted tests, the minimum score for the control class is 50, while the experimental class score is 70. Both classes have a maximum score of 98. The average score for the control class is 77.13, and for the experimental class, it is 83.90. The standard deviation for the control class is 10.151, whereas for the experimental class, it is 7.683. Therefore, we can conclude that the class using PJBL media outperforms the class using conventional learning methods.

The normality test seeks to determine if the study data follows a normal distribution, as required by the hypothesis. We can assume that the study data follows a normal distribution if the significant values (Sig) for all data in the Kolmogorov-Smirnov test exceed 0.05. If the significance value (Sig) for all Kolmogorov-Smirnov test data falls below 0.05, we can conclude that the study data lacks a regular distribution. Table 4.7 presents the results of the normality test as follows:

Table 4.7 Results of the Normality Test

Class	Data	N	Significance	Information
A (Kel. Control)	*Pretest*	31	,009	Not Normally Distributed
	Posttest		,200	Normally distributed
B (Ex. Experiment)	*Pretest*	31	,155	Normally distributed
	Posttest		,057	Normally distributed

Source: *SPSS 25 Analysis Results*

Table 4.7 presents the results of the normality tests conducted on the data from both the control and experimental classes. The absence of a normal distribution does not satisfy the assumption of normality for the two classes. The non-normal distribution of the sample prompts the use of a nonparametric test, the Wilcoxon test. The Wilcoxon test yielded a significance value of 0.000 (< 0.05), indicating a difference between the pretest and posttest findings. Consequently, it may proceed with a nonparametric test, specifically the Mann-Whitney test.

The results of the homogeneity test can be seen in Table 4.8 as follows:

Table 4.8 Homogeneity Test Results

	Levene Statistic	df1	df2	Significant	Description
Posttest	1.236	1	60	0.271	Homogeneous

Source: *SPSS 25 Analysis Results*

The table's data reveals that the significant value (Sig) for the homogeneity test, calculated from the mean, is 0.271, surpassing the significance level of 0.05. Despite the homogeneity of the data, the normality test reveals a non-normal distribution. Therefore, we will proceed with a nonparametric test, specifically the Mann-Whitney test. The table presents the results of the Mann-Whitney hypothesis test.

We conducted the N-gain test to evaluate the data, detailing the acquired information on the performance of each variable in the pretest and posttest scores of students in both the experimental and control groups. Table 4.9 presents the outcomes of the N-Gain Test as follows:

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Table 4.9 Average results of *pretest* and *posttest N-gain scores of* control and experimental classes.

Minimum Average Class Maximal Criteria				
Control	66.2948	19.35	96.61	Medium
Experiment	70.5345	33.33	97.50	High

Source: *SPSS 25 Analysis Results*

The table presents the average difference score, N-gain, in the control group. The mean N-gain score was 66.2948, equivalent to 66%, with a minimum N-gain of 19% and a high of 96%. Conversely, the experimental class achieved an average N-gain score of 70.5345, or 70%, with a minimum of 33% and a maximum of 97%. The average N-gain score indicates that the experimental class utilizing the PJBL learning paradigm positively influences student learning outcomes at UPTD SMAN 1 Sarudu.
The Mann-Whitney test seeks to determine if a significant difference exists between the experimental group and the control group. SPSS 25 facilitates the computation, and Table 4.10 displays the results as follows:

Table 4.10 Ranks postest data results

Ranks				
	Class	N	Mean Rank	Sum of Ranks
Learning outcomes	Experimental class (PJBL)	31	37.87	1174.00
	Konrol class (conventional)	31	25.13	779.00
	Total	62		

Source: *SPSS 25 Analysis Results*

Table 4.10 indicates that the learning result value in the experimental class was 1,174, whereas the learning outcome value in the control class was 779.

Table 4.11 *Mann-Whitney Test*

Test Statistics	
	Learning Outcomes of Writing Skills
Mann-Whitney U	283.000
Wilcoxon W	779.000
Z	-2.795
Asymp. Sig. (2-tailed)	.005

Source: *SPSS 25 Analysis Results*

The outcomes of the hypothesis test presented in Table 4.11 are as follows:
When the 2-tailed significance value surpasses 0.05, we accept the null hypothesis (Ho) and reject the alternative hypothesis (Ha). Accept the alternative hypothesis (Ha) and reject the null hypothesis (Ho) if the significance value (2-tailed) is less than 0.05.
According to Table 4.11, we are inclined to observe the asymptote value. The significance (2-tailed) is 0.005. The number is 0.005, which is less than 0.05. The results showed a rejection of the null hypothesis (Ho) and an acceptance of the alternative hypothesis (Ha), suggesting a significant influence of learning results on the application of the PJBL learning model.

DISCUSSION

We conducted this study at UPTD SMA Negeri 1 Sarudu using two classes: class Xb, which used traditional learning, and class Xa, which used project-based learning (PJBL). Prior to intervention, student learning results were subpar; however, after the implementation of the project-based learning model (PJBL), these outcomes improved. Additionally, the researcher administered pretest questions to all classes before treatment to assess their baseline competencies and delivered content on environmental change

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during four sessions. The control class is Xb, which uses traditional learning, whereas Xa utilizes a project-based learning paradigm. In the first meeting, we pose fundamental questions to the students, encouraging them to conceptualize the project and choose the theme of environmental change for their poster creation. The second meeting involves the establishment of a timeline and the allocation of tasks for the project, ensuring clarity in work duration. The third meeting focuses on monitoring the project's advancement and assessing any challenges encountered during execution. Finally, the fourth meeting entails the evaluation and presentation of the completed project posters before the class, alongside group members.

We gave both groups of students posttest questions after they had finished the four-part learning series to gauge how much they had improved after the intervention. We used SPSS version 25 to examine the data. The study found significant differences in students' biological knowledge before and after the introduction of project-based learning. Results from the intervention were superior to those from more conventional forms of instruction. After the exam, the experimental group averaged 1,174 points, whereas the control group only managed 779. We ran a Mann-Whitney U test on the posttest results and found a two-tailed significance level of 0.005, which is lower than the significance level of 0.05. This led to the rejection of Ho and the acceptance of Ha. Class X biology students at UPTD SMAN 1 Sarudu benefited greatly from the project-based learning approach, according to these results. Octaviyani, Kusumah, and Hasanah (2020), Widana and Septiari (2021), and Hikmah and Agustin (2020) found similar results, demonstrating that the PjBL learning paradigm enhances students' capacity for creative thinking in junior high school. According to studies conducted by Hikmiyah (2021), Rahmadhani & Mariani (2021), and P. T. Rahayu, Ilma & Putri (2021), the PjBL learning paradigm helps junior high school students become better problem solvers and also encourages them to think creatively.

The posttest scores in the experimental class have risen, indicating that project-based learning (PJBL) is an effective instructional strategy for teaching environmental change topics since it enhances learning outcomes. Kamaruddin et al. (2021) endorsed the assertion, stating that the project-based learning (PJBL) paradigm necessitates more student engagement in the learning process, including decision-making, observation, and data presentation. Enhancing favorable learning outcomes involves not just the intrinsic motivation of students but also the educational methods employed to create an engaging learning environment, such as enjoyable instructional models that can positively impact student performance. According to research findings (Fiana, Relmasira, & Hardini, 2019), using the project-based learning (PjBL) model at the primary school level results in beneficial enhancements in student learning outcomes compared to the problem-based learning (PBL) model. Other investigations, including the research by Manurung, Sormin, Novita, and J. B. Hutauruk (2022), have also produced similar results. It indicated that the PjBL model significantly enhanced the mathematical literacy skills of junior high school pupils. Apriliani and Panggayuh (2018) conducted the study. The Learning Model project-based learning (PJBL) encourages student collaboration by facilitating problem-solving during the design and completion of assigned projects, thereby enhancing educational outcomes. The findings of Pratiwi (2018) corroborate that the PJBL paradigm enhances students' collaborative abilities and academic performance. The PjBL learning model enhances cognitive thinking skills and mathematical communication, as supported by research from Chalim, Mariani, and Wijayanti (2019), which indicates its effectiveness in improving mathematical communication skills. Conversely, research by Seftiani, Zulyusri, Arsih, and Lufri (2021) suggests that the PjBL learning model also enhances the critical thinking skills of high school students.

CONCLUSION AND SUGGESTION

The research findings indicate a significant disparity in learning outcomes between the experimental and control classes utilizing the project-based learning model. The nonparametric statistical analysis, specifically the Mann-Whitney test, yielded a p-value of 0.005, which is less than 0.05, leading to the rejection of the null hypothesis (Ho) and acceptance of the alternative hypothesis (Ha). Consequently, we can conclude that the project-based learning model positively influences the learning outcomes of Class X biology students at UPTD SMA Negeri 1 Sarudu.

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