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The Influence of the Project Based Learning (PjBL) Model on Student Learning Outcomes

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Abstract: The purpose of the research to determine the effect of Project Based Learning (PjBL) model on student learning outcomes in optical instruments. The sampling technique used purposive sampling, obtained class XI MIPA 4 as experimental class and XI MIPA 5 as control class. The research design used was a nonequivalent control group design. The experimental class will be given treatment using the Project Based Learning (PjBL) model, while the control class will use the expository model (conventional learning). Learning outcomes abilities measured in the cognitive domain include: C1) remembering, C2) understanding, C3) applying, C4) analyzing, C5) evaluating, and C6) creating. The instrument used was 10 multiple choice questions. Data were analyzed using parametric statistics, namely Manova. The results showed a sinificance value of 0.000 < 0.05 and a value of $R_{count} > R_{table}$ where 0.359 > 0.350, so H_0 was rejected and H_a was accepted. So, can be concluded that there is an influence of the Project Based Learning (PjBL) model on scientific literacy and student learning outcomes in optical equipment material.

Keywords: Learning Outcames; PjBL Model; Students.

Introduction

Education is an effort used by humans to improve their self-quality (Rosnidar et al, 2021). One of the subjects in formal education that is often found is Natural Sciences subjects. Natural Science subjects are products, processes and attitudes discovered through exploration which produce knowledge which includes facts, concepts, principles, laws, formulas, theories and models (Jiniarti, et al., 2015). Physics is a branch of science learning whose results must be able to improve student learning outcomes as the final result (Khoiri et al, 2016). Learning outcomes are the abilities or knowledge that students have after following the learning process both in class and outside of class (Dakhi, 2020; Azhar et al, 2022; and Rizal, S et al, 2023).

According to the results of observations at SMAN 1 Narmada, it was found that student learning outcomes in five classes were still low, indicated by student learning outcomes that were still below the Minimum Graduation. To solve this problem, a learning model that is student-centered (centered on students) is needed which is able to involve students directly so that knowledge is obtained at the students' own will so that the teaching and learning process becomes more active and interactive. In line with Wahyuni et al. (2020) opinion, it is necessary to develop conducive learning experiences centered on students so that learning outcomes can improve.

One learning model that can be used is the Project Based Learning (PjBL) model. The Project Based Learning (PjBL) model is a learning model that is able to make students more active in solving problems through scientific stages within a certain time period to produce a product (Kemendikbud, 2020).The project-based learning model is also a model that is recommended for use by teachers by giving them the freedom to provide projects that suit the students' environment (Musdalifah et al, 2023). The syntax of the Project Based Learning (PjBL) model is providing stimulus, planning projects, determining activity schedules, supervising the project implementation process. The teacher carries out

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monitoring, assessment, and finally the evaluation stage (Wajdi, 2017). Model Project Based Learning (PjBL) is a model that is considered capable of improving student learning outcomes (Farihatun & Rusdarti, 2019; Efliana et al, 2022; Mayangsari, 2017; Fahadah et al, 2021; Solekhah et al, 2020). The aim of this research is to determine the effect of the Project Based Learning (PjBL) model on student learning outcomes in optical instruments as well as reflection material regarding the learning process using the Project Based Learning (PjBL) model to improve student learning outcomes from active learning.

Method

This type of research is a quasi-experiment in the form of a Nonequivalent Control Group Design, namely a design that provides a pre-test and post-test for each group (Sahir, S, H., 2021). The samples in this study were class XI MIPA 4 as an experimental class which was treated using the Project Based Learning (PjBL) model and XI MIPA 5 as the control class using expository model in SMAN 1 Narmada.

Table 1. Nonequivalent Control Group Research Design Design

Group	Pre-test	Treatment	Post-test
Experiment	O_1	X_1	O_2
Control	O_3	X_2	O_4

Information:

O_1 : Giving initial tests to the experimental class
O_2 : Giving the final test to the experimental class
O_3 : Giving initial tests to the control class
O_4 : Giving the final test to the control class
X_1 : Learning in the experimental class using models Project Based Learning (PjBL)
X_2 : Learning in the experimental class uses an expository model

The sampling technique uses a purposive sampling technique, namely a sampling technique with certain considerations (Sugiyono, 2020). The test technique used to measure learning outcomes is by giving 10 multiple choice questions. Before the pre-test, the author carried out an instrument test consisting of validity, reliability, level of difficulty and differentiability of questions to determine the suitability of the test instrument to be used with the required indicators (Fauzi et al., 2022).

After carrying out the pre-test, each class was given treatment and the last one was given a post-test as a comparison. Then prerequisite tests are carried out, namely normality and homogeneity tests. Next, a hypothesis test was carried out using the Manova test to see the effect of the Project Based Learning (PjBL) model on student learning outcomes (Irwan & Sauddin, 2021).

Result and Discussion

The learning outcomes measured in this research are cognitive domain learning outcomes starting from C1-C6 including: C1) remembering, C2) understanding, C3) applying, C4) analyzing, C5) evaluating, and C6) creating (Sahidu, 2018). Class XI MIPA 5 as the control class in this research was given treatment using the expository model (lecture method) while the experimental class was given treatment using the Project Based Learning (PjBL) model. Students in the experimental class are given the task of making a product related to optical instruments.

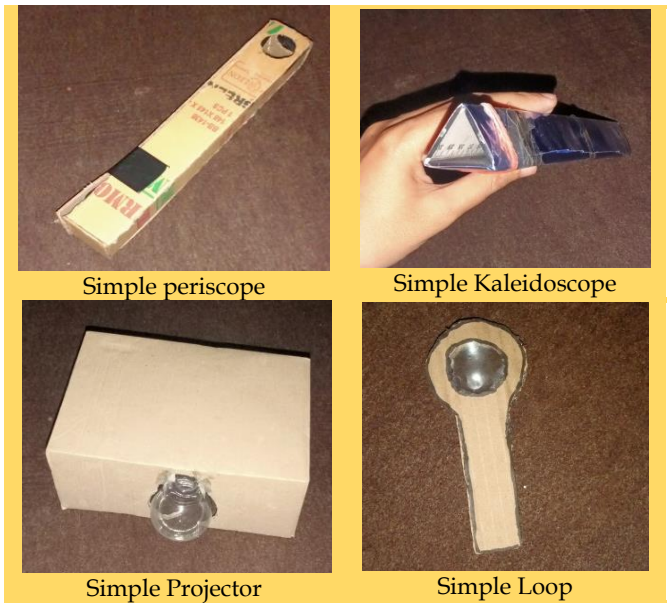

Figure 1. Experimental Class Product Results

There were two groups making a simple projector, one group making a simple kaleidoscope, one group making a simple periscope, and one group making a simple loop. During project creation, students actively find out independently the working principles of tools and matters related to optical tools.

Based on this data, it can be seen that the most significant increase occurred in the C2 evaluating domain and the domain that experienced the least increase was C5, the understanding domain. To see an increase in student learning outcomes, a comparison was carried out between the pre-test and post-test. The results of the students' pre-test and post-test can be seen in Figure 2. Based on Figure 3, it can be seen that the increase in learning outcomes in the experimental class is higher than in the control class. This indicates that the Project Based Learning (PjBL) model is considered capable of improving student learning outcomes (Subuki, et al. 2023; Made et al, 2022; Antara et al, 2019; Khoiruddin 2021).

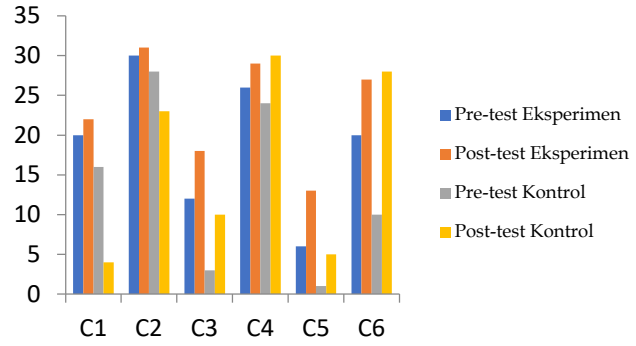

Figure 2. Increase Cognitive Domains C1-C6 Learning Outcomes in the Experimental and Control Class

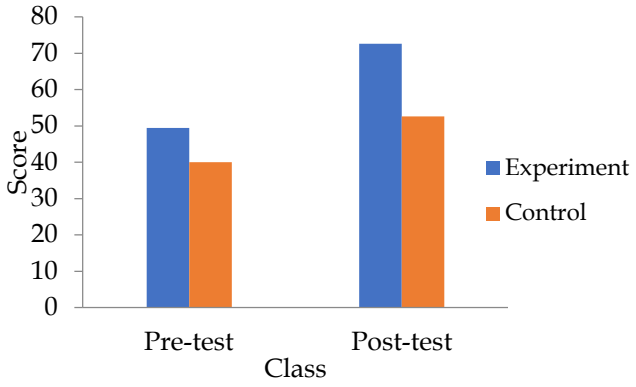

Figure 3. Graph of students' pre-test and post-test scores

Hypothesis from this research following H_0 mean there is no influence of the Project Based Learning (PjBL) model on student learning outcomes in optical instrument material and Ha mean there is an influence of the Project Based Learning (PjBL) model on student learning outcomes in optical instrument material. Before testing the hypothesis, a prerequisite test is carried out. The prerequisite tests in this research are the normality test and homogeneity test. Normality test results can be seen in Table 2. The normality test used was Shapiro-Wilk with a significance of 5% using SPSS 26. The significance value for each pre-test and post-test for the experimental class was 0.182 and 0.118, while for the significance value for each pre-test and post-test for the control class. are 0.141 and 0.118, all four variables are greater than 0.05 so it can be concluded that the data is normally distributed.

The next prerequisite test is the homogeneity test which can be seen in Table 3. Homogeneity was tested using SPSS 26 based on a significance value of 5%. It was found that the data results for the experimental class and control class were 0.875 and 0.949 respectively, both data were greater than 0.05 so it could be con cluded that the data were homogeneous. Once the conditions are met, a hypothesis test will be carried out using the MANOVA test.

Table 2. Normality Test Results

Class		Shapiro-Wilk Statistics	Df	Sig.
Experiment	Pre-Test	0.956	34	0.182
	Post-Test	0.949		0.118
Control	Pre-Test	0.952		0.141
	Post-Test	0.949		0.118

Table 3. Homogeneity Test Results

Class	Levene Statistics	df1	df2	Sig.
Experiment	0.025	1.000	66.000	0.875
Control	0.004	1.000	66.000	0.949

Table 4. Manova Test Results

MANOVA (Sig.)	Significance	R_{count}	R_{Table}	Criteria
0.000	0.050	0.359	0.350	H_a accepted

Based on Table 4, it can be seen that the significance value is 0.00 < 0.05 and the value is 0.359 > 0.350, which means $R_{count} > R_{table}$, so H_0 is rejected and H_a is accepted. So, it can be concluded that there is an influence of the Project Based Learning (PjBL) model on students' learning outcomes in optical instruments. In line with research conducted by (Wahyuningsih et al, 2021; Permana & Setiawan, 2019; Widana & Septari, 2021).

In the Project Based Learning (PjBL) model there are six steps, the first step is providing a stimulus where the teacher asks questions challenging and able to lead participants educate in the subject matter will be discussed in the project. The next step is planning the project, where the teacher guides students to planning the project to be created, divide tasks between group members, and choose the tools and materials that will be used. Then the student have to determine the schedule of activities. After that the student should carry out the creation of a project where the teacher carries out monitoring for control students' work and guide the project activities. Then assess the projects that students have made and the last is evaluation. After implementing this syntax, it was found that students experienced increased learning outcomes as can be seen in the Figure 2 and 3. According to Nisa and Yuliwati (2021) The Project Based Learning (PjBL) model is a learning model that is centered on the student process, where students are required to actively search for their own information and translate it to produce a product. There are two factors that influence learning outcomes, namely internal factors in the form of intelligence, physical, physiological, attitudes, interests, talents and intelligence and external factors in the form of the social environment and national environment (Imron and Sahyar, 2019). In this research, the use of the Project Based Learning (PjBL) model can stimulate the two

factors that influence learning outcomes, in line with research conducted by Hartati (2022) which states that the Project Based Learning (PjBL) model can improve student learning outcomes.

Conclusion

Based on the results and discussion there is an influence of the Project Based Learning (PjBL) model on student learning outcomes on proven optical instrument material with a hypothesis significance value of 0.00 < 0.05 and an R_{count} value > R_{table} 0.359 > 0.350 for learning outcomes so that H_a is accepted and H_0 is rejected.

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