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The Project Based Learning (PjBL) Model on Students' Scientific Literacy

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Abstract This purpose of the research is to determine the effect of Project Based Learning (PjBL) model on students' scientific literacy in optical instruments. The sample in this study was all students in class XI MIPA SMAN 1 Narmada. The Sample use in this research is purposive sampling technique we used class XI MIPA 4 was obtained as the experimental class and XI MIPA 5 was the control class. The research design used is a nonequivalent control group design , which means that the two classes will be given different treatment. Where 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). The scientific literacy abilities measured include aspects 1) explaining phenomena scientifically, aspect 2) designing and evaluating scientific investigations, aspect 3) interpreting data and evidence scientifically. The instrument used is 3 questions consisting of 3 descriptive sub-questions. Data were analyzed using parametric statistics, namely Manova . The results showed a significance value of 0.00 < 0.05 and a value of 0.237 > 0.226, which means calculated F > F table , so H_0 is rejected and Ha an is accepted. So it can be concluded that there is an influence of the Project Based Learning (PjBL) model on students' scientific literacy in optical instruments.

Keywords: PjBL Model; Scientific Literacy; Students.

Introduction

Education is a development process self -ability through learning as stated by Purwadarminta (1982) in Haderani (2018). In order to adapt to increasingly developing and globalized times, from an educational aspect it is necessary to increase scientific literacy . According to EOCD (2003) in Narut and Supriadi (2019) scientific literacy is a person's ability to use knowledge, identify questions, draw conclusions based on existing evidence to understand and make decisions related to science. In 2018, according to a survey from PISA (Program for International Student Assessment) Indonesia was ranked 62, 61 and 63 out of 69 countries respectively in the fields of science, reading and mathematics. This is in line with research conducted by Zulaiha & Kusuma (2021) which states that the literacy skills of junior and senior high school students are still low. Scientific literacy is related to science learning to provide opportunities for students to develop reasoning and problemsolving abilities (Nursamsu et al, 2023). Scientific literacy utilizes scientific concepts that students already know to use in everyday life (Rusmansyah et al, 2023). Teachers need to improve students' scientific literacy skills to face 21st century learning so that it focuses on real experiences (Nuraini et al, 2023).

Based on the results of observations at SMAN 1 Narmada, according to the physics subject teacher, students' scientific literacy abilities are still very low. This is caused by several factors, including the lack of school facilities to support the increase in students' scientific literacy, such as inadequate libraries and laboratories, textbooks that are not prepared to improve students' scientific literacy skills, teacher-centered learning models, lack of Human resources who understand scientific literacy, and the frequent

Cara Mengutip:
Contoh: Susilawati, S., Doyan, A., Muliyadi, L., & Hakim, S. (2019). Pertumbuhan lapisan tipis oksida timah dengan doping alumunium dan fluor menggunakan teknik spin coating Sol-Gel. *Jurnal Penelitian Pendidikan IPA, 1* (1), 1-4. https://doi.org/10.29303/jppipa.v1i1.264

misconceptions among students. Meanwhile, according to J. Witanto (2018), there are several bad consequences of students' lack of scientific literacy skills, including: 1) misconceptions regarding how to apply science, 2) lack of scientific insight which causes a lack of positive thinking, 3) creativity does not develop, 4) Difficulty in improving one's quality, 5) Closing oneself off from current developments, 6) Loss of human resource assets as a contribution of the younger generation to the nation's progress.

To solve this problem, a learning model that is student-centered (student-centered) 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 order to improve scientific literacy skills. One learning model that can be used is the Project Based Learning (PjBL) model. The Project Based Learning (PjBL) model itself is a learning model that is able to make students more active in solving problems and can be done individually or in groups through scientific stages over a certain period of time, producing a product which can then be communicated to other people (Ministry of Education and Culture, 2020). This model is considered capable of improving students' collaboration and cooperation abilities as a form of studentcentered learning (Maulidah et al, 2023) . 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 according to Wajdi (2017) is as follows : 1) provide stimulus, 2) plan the project, 3) determine the activity schedule, 4) supervise the project implementation process. Teachers carry out monitoring for, 5) assessment, and 6) evaluation. The Project Based Learning (PjBL) learning model is a learning model that is suitable for use in science learning (Yanti et al, 2023; Syukri et al, 2021; Kusumaningtyas et al, 2023; Mursalim et al, 2023; Aprida & Mayarni, 2023). The PjBL learning model is also considered capable of increasing students' understanding of the material to increase scientific literacy (Guo et al, 2020). Apart from that, according to Hanklang and Sivasan (2019) Project Based Learning provides work experience and understanding of how the theory studied works in real life.

Method

This research is quantitative research with a type of quasi-experimental research 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 population in this study were all students in class XI Science at SMAN 1 Narmada. 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 a control class with an expository (conventional) model.

Tabel 1. Research Design Nonequivalent Pretest Posttest Control Group Design (Sugiyono, 2020)

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

Information:

X_1 : The learning process uses the PjBL model

X_2 : The learning process uses the expository (conventional) model,

O_1, O_3 : Pre-test results

O_2, O_4 : Post-test results

The sampling technique uses a purposive sampling technique , namely a sampling technique with certain considerations (Sugiyono, 2020). The test technique used to measure scientific literacy skills is by giving 3 description questions with 3 sub-questions each. Before the pre-test, the author carried out an Page 1 of 4 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 a post-test as a comparison . Then a normality and homogeneity test was carried out as a condition for carrying out the Manova hypothesis test to see the effect of the Project Based Learning (PjBL) model on students' scientific literacy

Result and Discussion

After conducting research regarding the influence of the Project Based Learning (PjBL) model on students' scientific literacy, pre-test scores were found and post-test from the experimental class and control class. The pre-test is given before treatment is given, while the post-test is given after treatment is given. The scientific literacy test instrument consists of three aspects, namely: Aspect 1) explaining phenomena scientifically, Aspect 2) designing and evaluating scientific investigations, Aspect 3) interpreting data and evidence scientifically (Setiawan, 2019). The results of the students' pre-test and post-test can be seen in Figure 1.

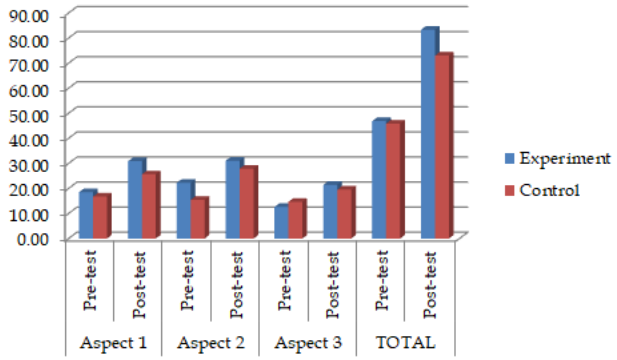

Figure 1. Graph of students' pre-test and post-test scores

Based on Figure 1, you can see the results of students' scientific literacy ability tests in terms of each aspect. From Aspect 1) the experimental class increased by 12.33 points, while the control class increased by 8.91 points, in this aspect students must have the ability to apply scientific knowledge in the situations that have been given (Ramadhani and Angela, 2021) Aspect 2) value the experimental class increased 8.79 points, while the control class increased 12.44 points. In this aspect, students are expected to be able to recognize questions that may be investigated scientifically, search for information, and identify keywords (Hidayah et al., 2019). Aspect 3) the experimental class score increased by 36.45 points, while the control class' score increased by 27.13 points. In this aspect, students are expected to be able to use procedural knowledge to analyze the data presented (Vashti et al, 2020). Based on Figure 1 , it can be seen that the average pre-test score for the experimental class is lower than the control class, while the average post-test score for the experimental class is higher than the control class. This indicates that the Project Based Learning (PjBL) model is considered capable of improving students' literacy skills.

In this research, the prerequisite tests used are the normality test and homogeneity test for conducting hypothesis. The results of the normality test can be seen in Table 1. Explaining scientifically known phenomena increases the value of experimental classes .

Table 2. Normality Test Results

	Shapiro-Wilk				
Kelas	Statistic	Df	Sig.	Sig.	Conclution
Pre-Test Eksperiment	.959	34	.230	.05	Normal
Post-Test Eksperiment	.953	34	.147		Normal
Pre-Test Control	.951	34	.134		Normal
Post-Test Control	.964	34	.313		Normal

The normality test used was Shapiro-Wilk with a significance of 5% assisted by SPSS 26. The significance values of the three variables are (0.230, 0.147, 0.134, 0.313 > 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.

Table 3. Homogeneity Test Results

Class	Levene Statistic	df1	df2	Sig.	Conclution
Eksperiment	1.810	1	66	.183	homogeneous
Control	1.349	1	66	.250	homogeneous

Homogeneity was tested using SPSS 26 based on a significance value of 5%, it can be concluded that the data is homogeneous. Once the conditions are met, a hypothesis test will be carried out using the MANOVA test. An explanation of the MANOVA test results can be seen in table 4.

Table 4. MANOVA Test

	Manova (Sig.)	$F_{culculate}$	F_{table}	Criteria
Scientific Literacy	0.00	0.237	0.226	H_a accepted

Based on table 4, it can be seen that the significance value is 0.00 < 0.05 and the value is 0.237 > 0.226, which means that F count > F table , so H 0 is rejected and H an is accepted, so it can be concluded that there is an influence of the Project Based Learning (PjBL) model on students' scientific literacy abilities. on optical instrument materials. This is in line with research conducted by Sakti et al, 2021; Marjanah et al, 2021; Ginting et al, 2023 ; and Kotimah et al, 2020 which states that the Project Based Learning (PjBL) model can improve students' literacy skills.

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, according to their opinion (Nisa and Yuliwati, 2021). According to Narut and Supriadi (2019) scientific literacy skills are very important abilities for students to be able to draw conclusions and make decisions based on existing evidence related to scientific issues . Based on this opinion, the Project Based Learning (PjBL) model is considered capable of being used as a learning model that can improve students' scientific literacy skills . As argued by (Khatimah , 2020 ; Anggraeni, 2020) which states that there is an influence between the Project Based Learning (PjBL) model and increasing students' literacy skills where this model involves students directly, stimulates students' skills and knowledge in solving problems to create it's a product.

Conclusion

Based on the results obtained using the Manova test with a significance value of 0.00 < 0.05 and a value of 0.237 > 0.226, which means calculated F > F table , H_0 is rejected and Ha is accepted, so it can be concluded that there is an influence of the Project Based Learning (PjBL) model on scientific literacy abilities students on optical instrument material. From the pre-test and post-test scores, it can be seen that students' scientific literacy scores have increased effectively. This model is considered capable of improving students' abilities in explaining phenomena scientifically, designing and evaluating scientific investigations, and interpreting scientific data and evidence.

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