Implementation of Probolinggo Local Wisdom-Based Problem-Based Learning Model to Improve the Science Literacy Skills of High School Students

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ABSTRACT

The characteristics of learning in the 21st century are directed at encouraging students to work together, be communicative, think creatively, think critically, think computationally, and have compassion. This study aims to apply a problem-based learning (PBL) model based on Probolinggo local wisdom to improve students' scientific literacy skills. The type of research used is quasi-experimental and uses a Nonequivalent Control Group Design. The type of research used is quasi-experimental and uses a Nonequivalent Control Group Design. This study used two class samples, namely class XII MIPA 1 as a class that will be given treatment (experimental) while class XII MIPA 3 as a class that is not given treatment (control). The Probolinggo local wisdom-based PBL model becomes the independent variable in this study. The dependent variable in this research is students' scientific literacy skills. The control variables in this study were the teachers or researchers, the number of students taught (sample), and the learning materials for dynamic fluids. This research obtained valid learning tools with a validity level of 89.2%. The level of implementation of learning is 94%. Applying learning to apply Probolinggo local wisdom-based PBL model effectively increases students' scientific literacy abilities. This was obtained from the results of the independent-sample T-test, showing that the significance value is 0.000, which is less than 0.05. An increase was seen from the N-Gain test, obtained 0.60 in the class that was given the treatment, while 0.05 in the class that was not. In the future, learning based on Probollinggo's local wisdom can be developed in dynamic fluid learning and linear material learning.

Introduction

Skills in current learning, namely the 21st century, that was initially only 4C skills (collaboration, communication, creative thinking, and critical thinking) are now becoming 6C which is also focused on compassion and computing. Therefore, the ability demanded is not only 4C but changes to 6C (Kemendikbud, 2017). The characteristics of learning in the 21st century begin to direct students to think critically, be communicative, creative and work together (Kemendikbud, 2020). These skills are one of the challenges from outside the scope of education, which is the cause of the emergence of the 2013 curriculum that was developed. Based on the Regulation of the Minister of Education and Culture, Number 70 of 2013 states that the 2013 curriculum has the characteristics of developing knowledge, attitudes, and skills that can be applied in various situations at school and in society (Kemendikbud, 2013). These characteristics are intended so that students' knowledge becomes deeper by utilizing nature and the environment as a source of learning (Adawiyah & Wisudawati, 2017).

Learning activities must be designed according to the needs of their use, one of which is the need based on the characteristics of regional wealth, including local

culture or traditions. This is confirmed in Based on the Law of the Republic of Indonesia Number 20 of 2003 concerning the National Education System in Chapter X article 36, paragraph (1) point (d), which states that in schools, it is mandatory to apply an educational model based on local potential found in each region (UU No. 20 the Year 2003 Article 36 paragraph 1). The local potential is also called local wisdom, a custom or habit in every region. Local wisdom holds on to cultural traditions and noble values to become a guideline in the rules of life in society in order to create a prosperous society. Local wisdom-based learning is usually applied to provide more contextual examples so that students have skills following the local potential in their area.

Indonesia is a country rich in cultural diversity and local wisdom. This is supported by (Antara & Yogantari (2018), which state that Indonesia has a cultural heritage that is influenced by its own culture and that of other countries, its own culture is Malay, while other countries are influenced by Arab, Chinese, Indian and European cultures that have developed over the centuries (Antara & Yogantari, 2018). For example, Wayang Kulit tells several stories related to the mythological events of the Hindu Ramayana and Baratayuda. One of the local wisdom in Indonesia is the Toancak Kite, located in Kotanyar Village, Paiton District, Probolinggo Regency. Tobacco farmers usually play Toancak kites. This game tests the dexterity of the farmers in playing kites. Farmers must be able to control the kite when hit by strong winds. Kites can fly because of the lifting force caused by the difference in airspeed, so there is a pressure difference. Learning through phenomena and social issues is the same as students learning scientific literacy. Scientific literacy is the basic knowledge for future threats (Bashooir & Supahar, 2018). Individuals who have high scientific literacy skills will be able to face threats in the 21st century.

PISA (Program for International Student Assessment) is a program that researches students' reading, math, and science literacy skills in various participating countries (OECD, 2018). The results obtained are very concerning, even though scientific literacy is needed in order to survive to be able to survive in the midst of global competition (Bagasta et al., 2018). From the results of research conducted by PISA in 2018, the scientific literacy value of Indonesian students was 396, where this value decreased after previously in the PISA research in 2015, the scientific literacy value of Indonesian students was 403 below the OECD average score of 487 (OECD, 2019). Based on PISA data, information is obtained that Indonesia needs to be higher regarding scientific literacy. The research

results also support Mardhiyyah et al. (2016) obtained information that Indonesia is in a low position in scientific literacy skills (Mardhiyyah et al., 2016). Preliminary research results from Utama et al. (2019) also show that students must still be capable of scientific literacy. This is evidenced by the low scores obtained in working on scientific literacy questions (Utama et al., 2019).

Many factors influence students' scientific literacy abilities, including learning models, teaching materials, learning media, student worksheets, and evaluation tools based on scientific literacy (Rusilowati et al., 2019). If these five factors are met, it will lead to the high scientific literacy of students. The main factor considered in improving students' scientific literacy skills is the compatibility between the learning models used and 21st-century learning, which includes the skills of the scientific literacy process, using material adapted to the analysis of student needs.

Science literacy skills that students must possess also include physics subjects. Physics is a science that is suitable for learning scientific literacy (Nurwulandari, 2018). One of the reasons for students' success in adapting to the times and technology is the development of their abilities in the field of Physics (Indrawati, 2018). Therefore, scientific literacy skills possessed by students can generate from the application of a good physics learning model. One of the physics materials that includes scientific literacy skills is Dynamic Fluids. Sabrina et al. (2021) show that students' scientific literacy in dynamic fluid materials is still a low ranking (Sabrina et al., 2021).

Look at the problem, and it is necessary to make improvements by applying a learning model that can improve students' scientific literacy abilities. The solution to overcome these problems and increase students' scientific literacy skills is by applying a problem-based learning model (Qomariyah et al., 2019). The problem-based application uses real-life problems, obtains information and concludes, uses logic and its validity in a context, and is then applied to solve problems and create better understanding. This learning model accelerates students' scientific literacy through investigative and analytical activities (Fauziah et al., 2019). The learning process related to social science issues positively influences literacy competency aspects (Rubini et al., 2019). The Problem-Based-Learning model developed is based on local wisdom and contains local wisdom to assist students in learning with real examples that are often encountered.

On the other hand, the urgency is also in line with the research focus of the State University of Surabaya

which is included in research to improve the quality of education. That way, this research has excellent substance if it is appropriately implemented. Therefore, this research needs to be carried out.

Found the problems significant, it is required to behavior a study on the Implementation of the Probolinggo Local Wisdom-Based Problem Based Learning Model to Improve the Science Literacy Skills of High School Students. This research has a specific goal, namely to increase students' scientific literacy ability.

Methods

Quasi-Experimental is a type of research applied by researchers. Furthermore, it uses a Nonequivalent Control Group Design. This research was implemented at SMAN 1 Dringu, Probolinggo. This study used two class samples, namely class XII MIPA 1 as a class that will be given treatment (experimental) while class XII MIPA 3 as a class that is not given treatment (control). The population used is students of class XII MIPA SMAN 1 Dringu. The Probolinggo local wisdom-based PBL becomes the independent variable in this study.

The dependent variable in this research is students' scientific literacy skills. The control variables in this study were the teachers or researchers, the number of students taught (sample), and the learning materials for Dynamic Fluids. The data collection process was done by pretesting two classes, namely control, and experiment, then applying the selected model, namely the PBL model, to the experimental class and then giving posttest questions to the experimental class. Data collection on the implementation of learning was obtained from observing the implementation of learning by observers in the experimental class.

The chosen instrument is the instruments to make observations on learning implementation and the test instruments for pretest and posttest. The analysis technique used is the validity test to regulate the instrument's validity level. In addition, researchers also used normality tests, homogeneity tests, t-tests, and N-Gain tests to describe the effectiveness of applied learning in improving students' scientific literacy skills.

Result and Discussions

This study aims to analyze the effect of the application Probolinggo Local Wisdom-Based Problem Based Learning Model on students' scientific literacy abilities.

The researcher carried out three treatments: a pretest at the beginning, a treatment to apply the learning model, and a posttest at the end of the lesson. In the early stages, the researcher gave pretest questions regarding the Dynamic Fluid material linked to the local wisdom of Probolinggo. The pretest is given at the beginning to determine the extent to which students' abilities are at the beginning of the meeting. Then the students were given treatment (experiments), namely the application of Probolinggo local wisdom-based PBL, namely the Toancak kite. In the final phase, posttest questions were given to determine students' scientific literacy abilities after applying the treatment.

Before conducting the research, the researcher tested the validity of the learning device. A validity analysis was conducted with three validators from expert lecturers from the FMIPA Physics Education Study Program at Surabaya State University to get learning tools in the valid category. Validated aspects include formulating learning objectives, the content presented, language, and time allocation. The results of the analysis of the validity of learning devices are described in Table 1.

Table 1

Results of the Validity Of Learning Devices

No	Validated Aspects	Expert Assessment			Average (%)	Criteria
		I (%)	II (%)	III (%)		
1.	Formulation of learning objectives	90	80	90	86,7	Very valid
2.	The content presented	95	100	95	96,7	Very valid
3.	Language	91,7	75	91,7	86,1	Very valid
4.	Time allocation	75	100	87,5	87,5	Very valid
	Average	87,9	88,7	91	89,2	Very valid

Based on Table 1, it was found that the Probolinggo local wisdom-based PBL on dynamic fluid material is very valid and can be used in physics learning. In formulating learning objectives, it gets a mean value of 86.7%, which includes very valid criteria. In the content statement section presented, an average value

of 96.7% is obtained, which is included in the very valid criteria. The language statement section produces an average score of 86.1%, which is included in the very valid criteria. An average value of 87.5% is obtained for the time allocation statement section, which is included in the very valid criteria. Overall, the average value of the validity of the learning device is 89.2% which is included in the very valid criteria.

During the process of learning activities in the class that was given treatment (experiment), an observation was made of the execution of learning by assessing seven aspects, namely the ability to open learning, the learning process, mastery of learning material, execution of learning steps, use of learning media, evaluation, and the ability to close learning. The results of observing the execution of learning can be seen in Table 2.

Table 2
Observation Results of Learning Implementation

| No.	Observed Aspects	Observer 1 (%)	Observer 2 (%)	Average (%)
1.	Ability to open learning	100	100	100
2.	Learning process	75	75	75
3.	Mastery of learning materials	100	100	100
4.	Implementation of learning steps	100	100	100
5.	Use of learning media	100	100	100
6.	Evaluation	100	100	100
7.	Ability to close learning	100	66,67	83,3
	Average	96,43	91,67	94

Based on Table 2, learning with the Probolinggo local wisdom-based PBL is well implemented, with an implementation percentage of 94%. The percentage of each aspect and the mean percentage of the execution of learning observed by two observers can be seen in Figure 1.

Based on Figure 1, it is familiar that the average level of learning execution in the ability to open lessons was 100%. The level of execution of learning on aspects of the learning process obtained an average of 75%. The level of execution of learning in the mastery of learning material obtained an average of 100%. The level of execution of learning in execution learning

steps obtained an average of 100%. The level of execution of learning using learning media obtained an average of 100%. The level of execution of learning in the evaluation aspect obtained an average of 100%. The level of execution of learning in the ability to close learning obtained an average of 83.3%.

Figure 1
Comparison of the Average Value of the Results of the Implementation of Learning by Observer 1 and Observer 2
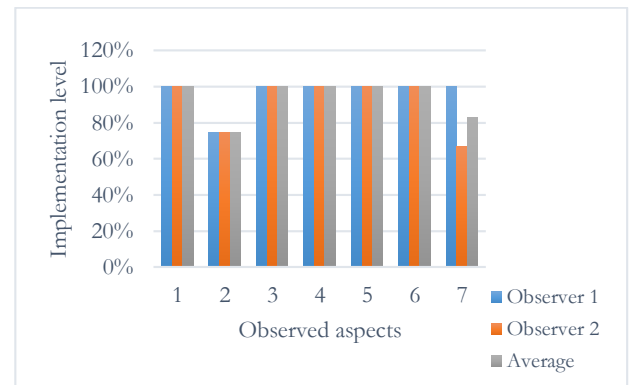
Learning has been going well, following the steps in the learning implementation plan. The statement that has not been implemented during the lesson is the expression of enthusiasm in teaching because the facial expressions when teaching is still flat. In addition, the statement that has yet to be implemented is the mobilization of the position of the place in the class because when teaching, the researcher only stands in front of the LCD screen. Learning with the Probolinggo local wisdom-based PBL has been running actively as evidenced by enthusiastic and participating students in answering questions. The core activity has formed literacy learning, characterized by students being able to deduce the concept of lift on Toancak kites reasonably.

The Normality Test was carried out to detect whether the data subject used as research were normally distributed. In line with the research results conducted by (Septian, 2017), the normality test is essential to know whether the data from the two classes used are normally distributed. The data distribution can be expected if the significance value found is more than 0.05. The following is the hypothesis formulation for the pretest and posttest data normality test in the control and experimental classes.

H_0: The sample is normally distributed.
H_1: Samples are not normally distributed.

Calculations were performed using the Shapiro-Wilk test with the help of SPSS software version 16.0.

According to (Hidayat, 2013) and (Razali & Wah, 2011), the Shapiro-Wilk test is the most effective normality test for a sample of less than 100. The test is carried out using a significance level of 5% with the following criteria:

H_o is received if (Sig.) $\geq$ 0.05.
H_1 is declined if (Sig.) < 0.05.

The results obtained in the two-class normality test at the pretest and posttest are described in Table 3.

Table 3
Normality Test Results

Class	Significance	Information
Pretest Experiment	0.207	Normal
Posttest Experiment	0.357	Normal
Pretest Control	0.719	Normal
Posttest Control	0.121	Normal

Based on Table 3, the results for the experimental pretest class were 0.207, the experimental posttest was 0.357, the control pretest was 0.719, and the control posters were 0.121. Based on the existing criteria, the two classes, namely the class that was given treatment (experimental) and not (control) samples are normally distributed. This indicates that the data were taken randomly from the average population.

The homogeneity test goal is to decide whether or not the two classes used as samples in the study are homogeneous. The hypothesis used to test the homogeneity of the variance of the pretest and posttest data is as follows.

Ho: Both classes are homogeneous population variances.
H_1: Both classes are inhomogeneous population variances.

The variance homogeneity test was carried out with the Levene test assisted by SPSS software version 16.0. According to (Garson, 2012), Levene's test determines differences in data from two groups with different variances. The test uses a significance level of 0.05 with the following criteria:

H_o is received if (Sig.) $\geq$ 0.05.
H_1 is declined if (Sig.) < 0.05.

The following data from the homogeneity test results are presented in Table 4. Based on the homogeneity test that has been carried out, it can be seen that the pretest data is 0.354 ($\geq$ 0.05). This shows that the initial tests in the control and experimental treatment groups were homogeneous, with a Levene statistic of 0.887. For the posttest data, 0.432 ($\geq$ 0.05) in the control and experimental classes are also homogeneous groups

with Leven Statistics 0.635. According to (Sharma & Kibria, 2013) and (Parra-Frutos, 2013), if the data being tested is homogeneous, then the differences that occur are fundamental differences between groups. Thus Ho is accepted.

Table 4
Data Variance Homogeneity Test Results

Control and Experimental Class Data	Levene Statistic	df 1	df 2	Significance	Information
Pretest	0.887	1	28	0.354	Homogeneous
Posttest	0.635	1	28	0.432	Homogeneous

To test the effectiveness of the execution of Probolinggo local wisdom-based PBL, it is analyzed using the d-t test, namely the independent sample T-test. The results obtained in the posttest data for the two classes used are in the class that was given treatment (experimental) and was not given treatment (control). Are described in Table 5.

Table 5
Independent Sample t-test Results for Posttest Experimental and Control Class Data

t	df	Sig. (2-tailed)
14.206	28	.000
14.206	26.559	.000

From table 5, it is known that the significant results obtained are equal to 0.000 <0.05. So there is a significant difference between the posttest results of the class that is given the treatment and that which is not. Hence, the execution of Probolinggo local wisdom-based PBL is considered effective in improving students' scientific literacy.

The N-Gain test was conducted to determine how much influence the model applied had on students' scientific literacy abilities after applying Probolinggo local wisdom-based PBL. The test results obtained are described in Table 6.

Table 6
N-Gain Test Results in the Experimental Class and Control Class

Data	Average	
	Experimental	Control
Pretest	46,6	42,33
Posttest	78,73	46,2
N-Gain	0.60	0.05

Table 6 shows that the class given the treatment gets a score of $0.60 \leq 0.7$ which is in the medium category. From table 6, the average value of N-gain in the class that was not given treatment was obtained at $0.05 < 0.3$, which is in the low category. So it can be deduced that the execution of Probolinggo local wisdom-based PBL could improve students' scientific literacy skills. This is supported by Arrozaqu & Setiawan (2022) that learning with problem-based learning models based on local wisdom effectively upgrades student learning outcomes. In addition, according to (Permata, 2019), there was a significant dissimilarity in the problem-solving abilities of students who used PBL models based on local wisdom and those who used conventional learning models. Thus, in the control class, which was not given treatment, it did not increase students' scientific literacy abilities.

Conclusions

Based on the research that has been done and the data analysis obtained, the learning device's validity level is 89.2% can be called in the very valid category. The level of implementation of learning is 94.4%. There is a significant dissimilarity between the posttest results of the class-given treatment (experimental) and no treatment (control). The Independent sample T-Test evidences this with sig $0.000 < 0.05$. This means that there is an influence of the execution of Probolinggo local wisdom-based PBL on students' scientific literacy abilities. Then for the analysis of the N-gain test on class data that was given treatment(experimental), an average N-gain value of 0.60 was obtained, which was in the medium category, and 0.05 was obtained in the class not given treatment(control) in the low category. So there is an increase in students' scientific literacy skills in the class given the treatment (experimental). This future hope learning based on Probollinggo local wisdom can be developed in dynamics fluid learning and linear material learning.

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