SCIENCE LITERACY SKILLS WITH THE UTILIZATION OF STUDENT WORKSHEET LEARNING TOOL BASED ON PROJECT-BASED LEARNING

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ARTICLE INFO:	ABSTRACT
	This study aims to determine the effect of project-based learning (PJBL) student worksheets against students science literacy abilities on the use of waste and natural materials in class X SMA Swasta Nusantara Lubuk Pakam in the 2023/2024 school year. The research method used is quantitative, in the form of a true experimental design. The research design used was a pretest-posttest control group design. The population in this study was all class X at SMA Swasta Nusantara Lubuk Pakam, with a total of 6 classes. The sampling technique used in this research is class random sampling. The research sample consisted of two classes: X-1, which was the experimental group using PJBL-based LKPD, and X-2, which was the control group using conventional LKPD. This research instrument is a description-based scientific literacy ability test. The results of the calculation of the hypothesis test using the independent sample t-test obtained a sig. (2-tailed) value < 0.05, indicating that the PJBL-based LKPD has a significant effect on students' scientific literacy abilities in the material on the use of waste and natural materials. This is an open access article under the CC–BY-SA license.

INTRODUCTION

The 21st century is characterized by the rapid development of science and technology (science and technology), which impacts all aspects of people's lives. People's lives have shifted rapidly towards increasingly modern and efficient improvements. Referring to this statement implies that education is faced with more severe challenges, the challenge is that education should be able to produce human resources who have the ability to face various challenges in life. The 21st century has multiple demands, namely the main competencies that must be possessed by students, including science literacy and innovation, mastering media and information, and life and career skills. Science literacy is an ability that needs to be developed towards learning (Maghfirah, 2023). According to the World Economic Forum (2015), one of the 21st-century skills needed by students is science literacy. Learners will be able to learn better and live in a modern society which is currently influenced by the development of science and technology through science literacy (Yuliati, 2017).

PISA (Program for International Student Assessment) in 2018, Indonesia ranked 74 out of 79 participating countries, with an average score of 371. This value is still far from other countries that have reached the average value of all PISA participating countries totaling 555 (OECD, 2018). According to Sudarisman (2015), the science literacy of Indonesian students is stated to be low, there are several causes, namely teacher-centered learning, teachers are only oriented toward the goal of mastering the material, teachers are not able to manage discovery or project-based learning and have not introduced questions or tests oriented to aspects of science literacy competencies such as PISA questions. Indicators of science literacy competency aspects are 1) the ability to recognize, offer, and evaluate explanations of various natural and technological phenomena, 2) the ability to explain and evaluate scientific investigations and to propose ways of answering scientific questions, and 3) the ability to conduct thorough analysis and evaluate scientific data, claims and arguments in various

representations and draw the necessary conclusions (OECD, 2019).

Based on the results of interviews with biology teachers at SMA Swasta Nusantara Lubuk Pakam revealed that they had never measured science literacy to students because the teacher had just heard about science literacy. The assessment carried out by the teacher is only limited to the assessment determined by the government in the learning curriculum, namely cognitive, affective, psychomotor, and has not mastered the independent curriculum assessment, namely the project to strengthen the profile of Pancasila students.

Passive learning implementation can be minimized through the use of learning tools and models. Learning tools in the form of LKPD can guide students to carry out discovery and project-based learning to improve the ability of students' science literacy competency aspects (Setiawani et al, 2021). The implementation of project-based learning has several syntaxes, namely gathering information, designing project plans, developing schedules, monitoring project progress, testing project results, and evaluation. Project discovery skills are an important part of science literacy. Learners are involved in discovering a concept of discovery-based learning and projects that make the ability of students' science literacy competency aspects more trained (Ratna, 2019).

Seeing these problems, the expected situation is that students can understand the material utilization of waste and natural materials using project-based learning worksheets to improve science literacy skills. Learning tools that will be used to improve students' science literacy skills emphasize the process of cooperation in groups, understanding scientific phenomena, evaluating and designing scientific investigations, and interpreting data and scientific evidence so that the goals to be achieved are not only academic ability in the sense of mastery of concepts but also competence in mastering the material utilization of waste and natural materials.

This study aims to determine the effect of project-based learning worksheets on the ability of science literacy of students in the

competency aspect on the material utilization of waste and natural materials in class X SMA Swasta Nusantara Lubuk Pakam.

METHOD

This research was conducted in class X SMA Swasta Nusantara Lubuk Pakam even semester in the March 2023/2024 school year.

The method used in this research is true experimental design. The dependent variable is the science literacy ability of class X students of SMA Swasta Nusantara Lubuk Pakam on the material utilization of waste and natural materials, while the independent variable in this study is a learning tool in the form of Project-Based Learning Learner Worksheets.

The population in this study were all grade X students of SMA Swasta Nusantara Lubuk Pakam in the 2023/2024 school year as many as 6 classes with a total of 213 students. The population is considered homogeneous based on the average daily test scores obtained for biology subjects. The sample in this study was two classes of students from the population using a class random sampling technique.

The research design used in this study was a pre-test post-test control group design. Researchers gave a pretest to students before learning and a posttest after learning. Thus, progress can be known accurately, because researchers can compare before learning and after learning.

The research steps have several stages that must be passed through the preliminary stage in which it includes making observations, consulting with the supervisor, and proposing problems to be studied. The preparation stage makes a research proposal design, teaching modules, student worksheets, and research instruments. The learning implementation stage, pretest-posttest. The final stage of data processing and data analysis of science literacy skills obtained from research and making conclusions.

Test analysis of indicators of competency aspects of science literacy skills in terms of several indicators, including explaining scientific phenomena, evaluating and designing scientific research, interpreting data

and scientific evidence using percentages correction.

Data processing techniques and data analysis in this study are prerequisite analysis using normality test, homogeneity, and continued with hypothesis testing using independent t-test.

RESULTS AND DISCUSSION

Results of science literacy skills based on indicators of competency aspects

The competency aspect has three indicators used in the science literacy test instrument.
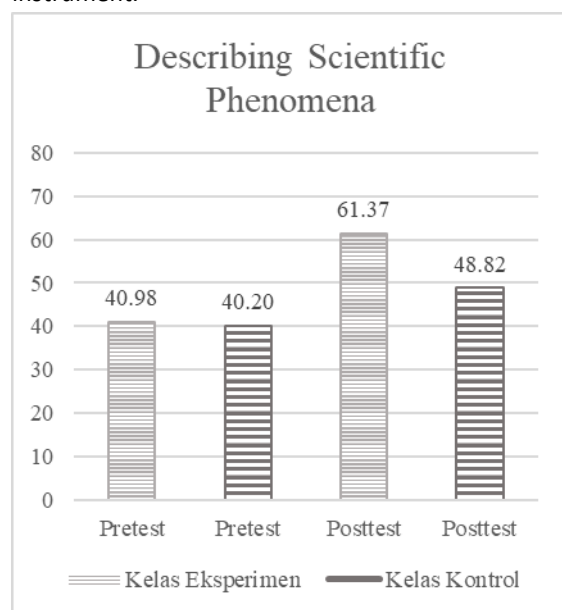

Figure 1. Science Literacy Results in Competency Aspects Indicators Explaining Scientific Phenomena

Figure 1 shows the pretest of science literacy of students for the experimental class is 40.98 (sufficient), the control class pretest results are 33.72 (low) while for the posttest in the experimental class, the science literacy results are 61.37 (high) and the control class posttest is 48.82 (sufficient). The results of the data in Figure 1 are an increase in science literacy in the competency aspect of the indicator explaining scientific phenomena, the first learning material subchapter of regulation and utilizing waste reduction, the second material subchapter discusses the correct processing of waste, the third material subchapter of hard waste materials used as accessories in the experimental class has increased significantly using

the PJBL-based learning model, the control class science literacy value has also increased.

Figure 2 Science Literacy Results in the Competency Aspect of the Evaluation and Designing Scientific Research Indicator
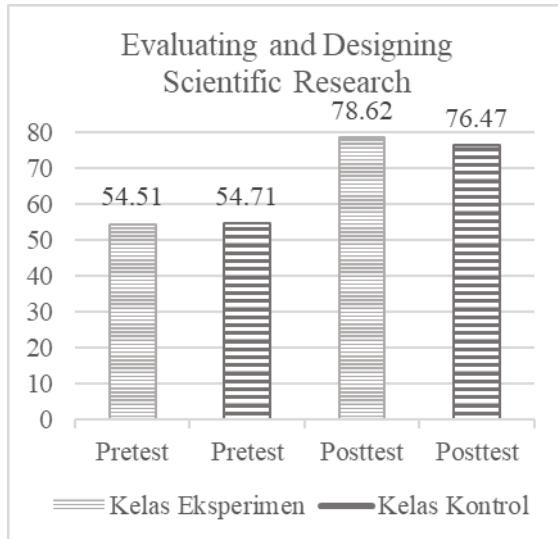

Figure 2 shows the pretest of students' science literacy for the experimental class is 45.29 (sufficient), the control class pretest results are 54.71 (sufficient) while for the posttest in the experimental class, the results of science literacy in the competency aspect of the evaluation indicator and designing scientific research are 78.62 (high) and the control class posttest is 76.47 (high). The results of the data in Figure 2 are an increase in science literacy in the competency aspect of the evaluation indicator and designing scientific research, the fourth learning material subchapter of water waste treatment using Pandora L, the fifth material subchapter discusses the problem of infertile soil, the sixth material subchapter analyzes waste from nature in the experimental class has increased significantly using the PJBL-based learning model, the control class science literacy value has also increased.
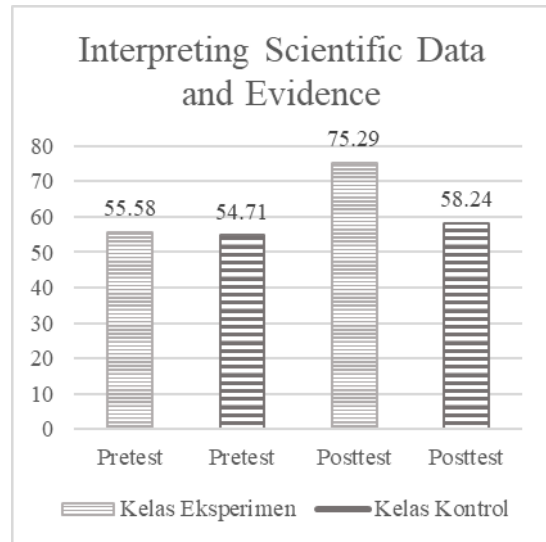

Figure 3 Results of Science Literacy Competency Aspects of Indicators Interpreting Data and Scientific Evidence

Figure 3 shows the pretest of science literacy of students for the experimental class is 55.58 (sufficient), the control class pretest results are 38.82 (low) while for the posttest in the experimental class, the results of science literacy in the competency aspect of the indicator interpreting data and scientific evidence are 75.29 (high) and the control class posttest is 41.17 (sufficient). The results of the data in Figure 3 are an increase in science literacy in the competency aspect of the indicator to interpret data and scientific evidence for the seventh learning material subchapter of crafts from plastic waste, the eighth material subchapter of B3 waste processing technology in the experimental class experienced a very significant increase using the PJBL-based learning model, the control class science literacy value experienced an insignificant increase.

Normality Results of Science Literacy Skills

The normality test carried out using SPSS uses the Kolmogrov-Smirnov test. Normality is used to see if the resulting data is normally distributed. The normality results are presented as follows in table 1:

Table 1. Normality Test Calculation Results

	Class	Kolmogorov-Smirnova			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Science Literacy Skills	Pre-Test Eksperimen (LKPD PJBL)	.112	34	.200	.975	34	.609
	Post-Test Eksperimen (LKPD PJBL)	.095	34	.200	.966	34	.367
	Pre-Test Kontrol (LKPD Konvesional)	.111	34	.200	.979	34	.734
	Post-Test Kontrol (LKPD Konvesional)	.080	34	.200	.969	34	.433

Results of Homogeneity of Science Literacy Ability

The homogeneity test is used to see whether the data can represent the existing population or not. The homogeneity test uses SPSS with the provision that the sample is said to be homogeneous if the significance value is> 0.05. The homogeneity test results are presented in the following table:

Table 2. Homogeneity Test Calculation Results

		Levene Statistic	df1	df2	Sig.
Science Literacy Skills	**Based on Mean**	.993	1	66	.323
	Based on Median	.950	1	66	.333
	Based on the Median and with adjusted df	.950	1	65.725	.333
	Based on trimmed mean	1.038	1	66	.312

The Effect of PJBL-Based LKPD on Science Literacy Skills

Hypothesis testing using independent sample t-test data must be normally distributed and homogeneous. Based on the normality and homogeneity tests that have been carried out, it is known that the data is normally distributed and the data is homogeneous so the calculation results in SPSS are based on the "equal variance assumed" table. The results of the independent sample t-test output have several parts such as Levene's test for equality of variances significance value 0.323> 0.05 so that the variance between groups is the same and homogeneous. t-test for equality of means has two lines, namely the assumption of equal variances (equal variances assumed) and unequal variances (equal variances not assumed). The results of the t-test with the assumption of equal variances show that there is a significant difference between the means of the two groups, the mean of group one is 14.044 greater than the other group, and the 95% confidence interval for the difference between 9.090 and 18.998 which indicates that the difference in means between the two groups is significant. The result of the hypothesis testing criteria is sig. (2-tailed) <0.05. Calculation of the value of science literacy skills obtained Sig. (2-tailed) of 0.000 <0.05, then there is an effect of project-based learning worksheets on students' science literacy skills compared to student worksheets that contain questions on the material utilization of waste and natural materials.

Discussion of Students' Science Literacy Skills Based on Indicators of Competency Aspects

The competency aspect is the core of science literacy skills. Students during learning are expected to have an awareness of phenomena that occur in everyday life, which are related to the utilization of waste and natural materials. Students are also expected to be able to solve the problems presented in the questions using the knowledge they have learned to build competence. The application of scientific knowledge in the current era is needed for the survival of living things on Earth, and its utilization can pay attention to the preservation of nature.

a. Explaining Phenomena Scientifically

The expected competency in explaining phenomena scientifically is that students can recall knowledge that has been learned that is appropriate to certain conditions and use it to explain these conditions. Students who have science literacy skills are expected to be able to explain phenomena scientifically about events in

everyday life. This competency received a percentage of 61.37, including in the high category.

b. Evaluating and designing scientific research

The results of the competency test to evaluate and design scientific research obtained a percentage of 78.62 (high). This competency requires students to understand where a finding comes from and the methods used to produce accurate and precise data. The purpose of this competency is to critically evaluate scientific findings and design research.

c. Interpreting scientific data and evidence.

Students who have the competence to interpret scientific data and evidence are required to be able to convey evidence or reasons about a scientific finding using the students' sentences. This competency received a percentage of 75.29, including in the high category.

The Effect of PJBL-Based LKPD on Science Literacy Skills

The influence contained in this study is evidenced by the results of the experimental class science literacy skills that are higher than the control class. The increase in science literacy skills that occurs is due to students who learn actively in understanding the material and creating projects to the fullest. Students making projects are trained to provide information, adjust, access, increase understanding and cooperation in making projects (Taupik and Fitria, 2021).

The improvement of students' science literacy skills on the material of utilizing waste and natural materials is influenced by project-based learning worksheets. These learning tools and models make students able to understand material that tends to prioritize processes and has complicated characteristics.

Nurhadiyati et al (2021) stated that learning with the PjBL learning model allows students to work in groups so that they gain deeper knowledge. The application of the PjBL learning model to the material on the utilization of waste

and natural materials allows students to relate to real life and apply it to daily life.

CONCLUSION

Based on the results of research and data analysis that has been done, it can be concluded that project-based learning (PJBL) based LKPD has a significant effect on the science literacy skills of students on the material utilization of waste and natural materials. PJBL-based LKPD is more influential than conventional LKPD on science literacy skills on the utilization of waste and natural materials. This is because PJBL-based LKPD presents structured problems with PJBL steps that will lead students to find out information by reading so that it can improve students' science literacy skills.

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