Cendikia
Jurnal Pendidikan dan Pengajaran
ISSN: 3025-1206
2025, Vol. 3, No.4
41-47

THE EFFECT OF PROJECT-BASED LEARNING ON THE SCIENTIFIC LITERACY OF PROSPECTIVE TEACHER STUDENTS

Wilyati Agustina [1)], Suhartatik [2)]
Insan Budi Utomo University
wilyanti310875@gmail.com, suhartatiksih@gmail.com

Abstract
The results of the study show that overall scientific literacy before and after the implementation of *project-based learning* experienced an increase in scientific literacy which is inseparable from the learning that. applied, namely *project-based learning*. *Project-based learning* provides students with the opportunity to explore concepts applied in everyday life or in outside the classroom. This results in more meaningful student *understanding* because knowledge is integrated with everyday life experiences through collaboration and problem-solving.

Article History
Submitted: 18 Juli 2025
Accepted: 21 Juli 2025
Published: 22 Juli 2025

Key Words

Introduction

Scientific Literacy *is the understanding and application of science in everyday life (Soobard & Rannikmäe, 2011; Azis et al., 2015).* ***Scientific Literacy*** *directing students to the character and values to make the right decisions (Oluwatelure, 2012). Students who are said to have good scientific literacy understand scientific concepts, have scientific reasoning skills, and are able to use knowledge about science (EOCD, 2016; Series, 2017).* Several studies have shown that students' scientific literacy is still low in terms of content, competency, and context (B. Rubini *et al* ., 2017; Rubini & Permanasari, 2014; Nur'aini *et al.* , 2018). Students' scientific literacy levels are also low at all levels (Nwosu & Ibe, 2014). Many factors contribute to low scientific literacy.

Scientific literacy should be instilled in schools (Udompong & Wongwanich, 2014; Putra *et al* ., 2016). Therefore, scientific literacy should be supported by learning strategies that vary (Nwosu & Ibe, 2014; Rokhmah *et al* ., 2017; Sulisworo & Sutadi, 2017). The learning process should motivate students (Adolphus *et al* ., 2012). In addition, the material taught should be connected to everyday life (Hendi Ristanto *et al* ., 2017).

Project Based Learning is *a Project Based Learning* which is a learning model innovative teaching many important strategies For skills in the 21st century , namely push student in learning they Alone through investigation , as well as Work The same For research and create projects that reflect knowledge they (Bell, 2010). PjBL referring to philosophical constructivism , so that student can construct his knowledge Alone through real experience . PjBL make an effort involving student in design , problem solving problem , taking decision , or activity investigation , providing student chance For Work in a way relatively independent in term a long time and in the end produce product or realistic presentation (Thomas, 2000). Students can choose activities and work carried out during activity project taking place , students can also become communicative , creative and developing thinking practical Because they involved in investigation / discovery and retrieval decision in a way active (McGrath, 2002). The benefits of PjBL in this way are expected to be obtained by students, namely increased problem-solving skills, increased library literacy skills, and internet research skills, increased collaboration, increased resource management skills, research that supports projects, and constructivism (Gibbs, 2003 in Mihardi *et al* ., 2013). Students' scientific literacy acquisition is better by using Project-based learning. Students' scientific literacy

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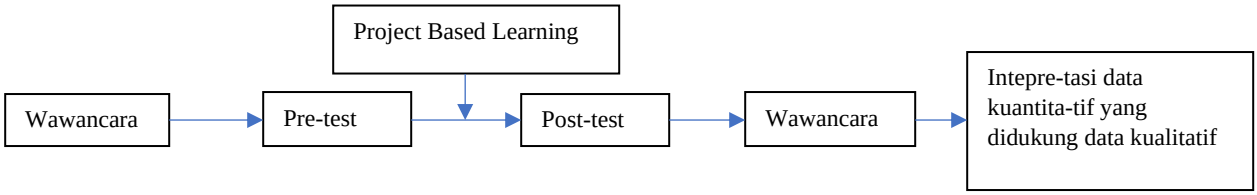
increased after the implementation of *PjBL* integrated with *STEM* (Afriana et al., 2016).The aim of this study is to determine changes in Scientific Literacy through Project-based Learning.

Research Method

This research is a *mixed methods study*. Data collection methods used quantitative and qualitative data. Quantitative data supports qualitative data. The research design is presented in Figure 1.1.



Study This started with interview First For know the usual learning model implemented , and understanding students . Next done *pretest and posttest* For understanding scientific literacy. Interview second conducted on students based on results mark *pretest and posttest* related project-based learning model response . After the data is collected done interpretation of quantitative data supported by qualitative data .

Subject Study

Subject study 38 students from the 2022 intake of the UIBU Biology Education study program in the Basics course science . All student follow *pretest and posttest.* Subject determined with *purposive sampling* , which has varying abilities .

Instrument Study

Instrument research used in study This as following **:**

a. Interview Guide

Interview guide containing about guide various first submitted to student For know understanding and experience learning.Instruments done in the form of question open .

b. Test *Scientific Literacy*

Test *scientific literacy* in the form of essay questions about basics science . Test This expected capable know difference *scientific literacy* before and after applied learning model *project-based learning.*

Data analysis

Analytical techniques used in research This consists of from the test data analysis techniques and research data analysis techniques described as following .

1. Trial Data Analysis Techniques

   The test questions were conducted on Biology Education study program students from the 2022 intake. The test question analysis techniques consisted of the level of difficulty of the questions, the discriminating power of the questions, the validity of the questions, and the reliability of the questions as follows.

   a. Question Difficulty Level A good question is neither too easy nor too difficult. The formula used to measure the level of difficulty of the questions is as follows.

      P (index Difficulty) = Number students who answered correct / amount participant test

      The provisions for classifying the difficulty index can be seen in Table 1.1 (Arikunto, 2013: 223).

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Table 1 Criteria for the Level of Difficulty of Questions.

Mark	Category
$P < 0.30$	Difficult
$0.30 \leq P \leq 0.70$	Currently
$P > 0.70$	Easy

b. Distinguishing Power Question

Power differentiator question is ability question For differentiate between students Which capable tall with student Which capable low. To calculate the discriminatory power of questions (Arikunto, 2013: 226) the following formula is used.

D= (BA/JA)-(BD/JB)= P_A -P_B

Information:

D = Power different
J_A = Amount student upper class
J_B = Amount student lower group
B_A = Amount student group on Which answer correctly
B_B = Amount student group lower Which answer Correct
PA = Proportion participant upper class Which answer Correct
P_B =Proportion participant group lower Which answer correctly

Table 2. Distinguishing Power Criteria Question

Mark	Category
$0.00 \square D < 0.20$	Bad
$0.20 \square D < 0.40$	Currently
$0.40 \square D < 0.70$	Good
$0.70 \square D \square 1.00$	Good Very

c. Validity Item Question

Validity is a measure that indicates the level of validity or authenticity of an instrument. The validation test used in this study is coefficient correlation (Arikunto, 2013: 93) which formulated like following.

d. $$r_{xy} = \frac{N \sum xy - (\sum x)(\sum y)}{\sqrt{\{N \sum x^2 - (\sum x)^2\}\{N \sum y^2 - (\sum y)^2\}}}$$

Information :

r_{xy} = coefficient correlation *product moment*
N = amount respondents
$\sum x$ = total score test items
$\sum y$ = total score total

Calculation validity grains question use SPSS. If mark $r_{hitung} > r_{tabel}$, so grains question stated valid with level significance 0.05

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e. Reliability Question

Reliability indicates the level of dependability of something. Reliable means it can be trusted So can reliable. For know reliability all over The test used the *Cronbach's Alpha formula* (Djaali & Muljono, 2008) as follows.

$$\alpha = \frac{k}{k+1}\{1 - \frac{\sum P_i q_i}{S^2}\}$$

The criteria for a question are reliable if the calculated coefficient value (α) ≥ 0.5 , at the level significance 5%. Retrieval decision based on on criteria Table 3.

Table 3.3 Criteria Reliability Question.

Scale	Category
0.8 $\leq r_{kk} \leq$ 1	**Very Tall**
0.6 $\leq r_{kk} \leq$ 0.79	**Tall**
0.4 $\leq r_{kk} \leq$ 0.59	Good
0.2 $\leq r_{kk} \leq$ 0.39	**Low**
0.0 $\leq r_{kk} \leq$ 0.19	**Very Low**

2. Technique Analysis Research Data

Technique analysis data study can explained as following.

a. Analysis Literacy Student Scientific

Literacy scientific student analyzed based on mark *pretest* And *posttest* .

b. Paired T-test

Test t-pair used For know difference mark *pretest* and *posttest* . Before conducting the paired t-test, a prerequisite test was conducted, namely the normality test. The statistical hypotheses tested in this study are as follows:

H $_0$: there is no difference between *pretest* and *posttest* scores

H $_1$: there is difference mark between *pretest* And *posttest*

H $_0$: $\mu_1 = \mu_2$

H $_1$: $\mu_1 \neq \mu_2$

Results and Discussion

1. Data Scientific Literacy

a. Table 4 Validity Test Butri Question Scientific Literacy

r_{htung}	0.6777	0.513	0.577	0.506	0.491	0.336	0.517	0.380
r_{tabel}	0.158	0.158	0.158	0.158	0.158	0.158	0.158	0.158
Information	valid	valid	valid	valid	valid	valid	valid	valid
Level Difficulty	0.4	0.6	0.4	0.5	0.4	0.4	0.4	0.6
	Currently	Currently	Currently	Currently	Currently	Currently	Currently	Currently

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Power different question	0.3	0.2	0.6	0.5	0.4	0.6	0.4	0.6
	Enough	Enough	Good	Good	Enough	Good	Enough	Good

b. Table 5 Reliability Test of Scientific Literacy Question Items

Quantitative data on scientific literacy is shown from *pretest* and *posttest scores* . This data can be seen in Table 6.

Reliability Statistics

Cronbach's Alpha	N of Items
,548	8

Table 6 Results *Pretest* And *Posttest Scientific Literacy*

	N	**Min**	**Max**	**Mean**	**Std. Dev**
Pretest	38	14	19	18.78	2.53782
posttest	38	25	30	22,552	2.77248

The results of the normality test using *the Shapiro walk* obtained a *pretest significance* of 0.162 and *a posttest significance* of 0.073. *The pretest* and *posttest significance values* were greater than 0.05, indicating that the data were normally distributed. The *pretest* and *posttest data* were normally distributed, so they could be tested using *a paired sample t-test* in SPSS 20. test the show that there is difference literacy scientific with significance of p = 0.000.

Table 7 Results Test Statistics

	Statistics	**Mark**	**Category**
Paired sample t-test	Mark t	-11,768	
	Asymp.sig (2 tailed)	0.000	*Different significant Posttest> pretest*
N- gain		0.3	Currently
Cohen's d-effect size		0.7	Currently

Table 7 show results test statistics data *pretest* And *posttest* . Changes in students' scientific literacy can be seen in the results of *the effect size calculation* of 0.7 which classified as currently (Cohen, 2007). Value *n-gain* obtained The average value is 0.3, indicating that it is in the moderate category. Thus, it can be concluded that *project-based learning* has an impact on *Scientific Literacy.*

Conclusion

The level of scientific literacy used is based on Bybee, there is an increase in the level of *scientific literacy* students as a whole with the project based learning model.

Acknowledgements

Thank You For Biology Education study program students who have give response positive to study This .

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