Student's Science Literacy Ability Through the Problem Based Learning Model in the Environmental Change Context

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Abstract. Student's Science Literacy Ability Through Problem Based Learning In The Environmental Change Context. This research aimed to analyze the effectiveness of Problem Based Learning towards student's science literacy ability for grade X in "Environmental change" context. This study was conducted at MAN 1 Pringsewu by quasy experiment with pretest-posttest control group design. The instrument used on this research was test of science literacy ability which consist of ten descriptive questions based on the construction patterns in the Programme for International Assessment (PISA) questions. The result of the statistic T-test showed a significant difference between the average value of science literacy ability of students in the experimental class and the control class. Based on this result, it can be concluded that student's science literacy ability through Problem Based Learning models are higher than without using Problem Based Learning in the "Environmental Change" context.**Keywords :** science literacy ability , environmental change , *problem based learning*.

1. Preliminary

Countries with abundant natural resources without being balanced with human resources who are able to manage their natural wealth well, then natural resources that should be able to improve welfare and progress for their citizens will never be realized [1]. Good education in terms of systems and implementation is expected to be a solution, by forming a generation that is ready to face global competition in various fields so that it can meet the demands of competent human resource needs in facing the era of globalization. This demand is commonly referred to as 21st century competence.

The development of science and technology is in line with the changing times. In order to survive in the rapid pace of this development, the world of education was also chosen to form an update. Indonesia is currently implementing the 2013 curriculum as a manifestation of renewal efforts developed to produce quality students. There are 4 points for the development of the 2017 revised 2013 curriculum : 1). Strengthening Character Education, 2). Creative, Critical Thinking,

Communicative, and Collaborative (4C), 3). Higher Order Thinking Skill (HOTS) , 4). Scientific literacy.

Natural Science (IPA) is often referred to as science. As a science, science has unique characteristics and characteristics that distinguish it from other sciences. Science is knowledge whose truth has been tested empirically through the scientific method. Science consists of chemistry, physics and biology [10]. Biology is a Natural Sciences that studies relating to living things, the environment, relationships between living things, and reciprocal relationships between living things and the environment.

In the learning process requires a process of using science or scientific literacy. Science literacy is the ability to use science knowledge, identify questions, and draw conclusions based on evidence in order to understand and make decisions regarding nature and changes made to nature through human activities [2]. PISA [7] in the Draft Science Framework, develop the scientific literacy into four dimensions: the context, knowledge, competencies and attitudes [6].

The 2013 curriculum is designed to be able to keep hand in hand in the development of science and technology with external challenges related to the shift of world economic power as the influence and impact of technology and the transformation of the education sector. The 2013 curriculum has also accommodated the evaluation results of the International Program for International Student Assessment (PISA) study [4].

From 1999 to 2015 the PISA results showed that Indonesian student's literacy skills were still relatively low. It is noted that the average score for achieving scientific literacy in Indonesia is ranked 62 out of 70 countries participating in it. Conclusions from the results of the PISA assessment regarding Indonesian scientific literacy skills up to 2015 are always ranked in the bottom 10 of the total participating countries [7].

The factors that can cause low scientific literacy in Indonesia are gender, economic and social, as well as immigration [8]. In addition, according to Kurniasih [5] factors that cause the low literacy skills of students include the curriculum and education system, the selection of methods and models of teaching by educators , learning facilities and facilities, learning resources, teaching materials, and so forth.

The results of a preliminary study conducted at MAN 1 Pringsewu on Thursday, November 15, 2018 by distributing questionnaires with the aim to determine the initial abilities of scientific literacy of students in terms of aspects of the assessment of "attitude" to learning biology. The attitude aspect has 3 categories, motivation to learn, the process of learning biology and the curiosity of students towards biology. The results show that, students of class X MIA 1 and 2 MAN 1 Pringsewu have a high biological attitude in terms of learning motivation with a percentage of 68% and the process of learning biology with a percentage of 67.5%. However, the level of curiosity of students is considered still low because it has a percentage of 63%. A low curiosity becomes the cause of the students' level of scientific literacy to be low. A low curiosity makes students not optimal in using scientific literacy as an effort to solve scientific biological problems and in real situations to solve environmental problems. Students 'scientific literacy skills are very dependent on students' attitudes towards science, in this case biology.

In addition, based on the results of interviews with biology subject educators, the method often used in learning activities is lecture and discussion methods, depending on the material being taught. Learning by using the lecture method is not in accordance with the competency demands that exist in the 2013 curriculum, because learning will be centered on educators (teacher centers), as a result students will become less active and learning indicators not achieved optimally. In addition, the lack of facilities and learning media is also a problem in learning. Students only rely on books from the school library, so the source of literacy is very limited. This is why students rely more on "gadget" because they are considered faster, easier and more practical to find information instantly rather than doing scientific literacy. The response of students in solving biological problems is still low, only a few students are able to think critically and enthusiastically to solve these problems. The

understanding of educators who are still poor about scientific literacy is also a factor in low ability student scientific literacy.

The learning model that is applied in accordance with the conditions of the learning environment is very influential in an effort to improve students' scientific literacy skills. Therefore, it is important to find a model that can provide a learning atmosphere that can improve students' abilities both in terms of knowledge, processes, competencies and scientific literacy attitudes.

Learning models that are expected to meet these criteria are one of them is Problem Based Learning. In addition, if referring to the objectives of the national education system, science learning and the revised 2013 curriculum objectives, the Problem Based Learning model can be used as a solution to answer the needs of students to prepare themselves in the face of the demands of the 21st century . This research is aimed to analyze the ability of science literacy learners through Problem Based Learning in class X MAN 1 Pringsewu in the context of environmental change.

2. Methods

This research was conducted at MAN 1 Pringsewu in the even semester of the academic year 2018/2019 . Objects in this study arestudent in X grade. This study involved an experimental class, namely class X MIA 1 and one control class, namely X MIA 2 , where the experimental class as a class treated with Problem Based Learning (PBL) models, while the control class as a class with conventional learning.

This study was a quasi-experimental study with a non-equivalent research design pretest and posttest control group . The instrument used is the test description totaling 10 questions in the form of pretest and posttest in the subject matter of environmental change. The instrument validity test used is content validity test. Content validity test is carried out through validation by lecturers who have expertise in the field of biological material, to see the suitability of the content standards of the material contained in the test instrument. Based on the results of the analysis of the test of scientific literacy skills that have been carried out in class X MIA at SMAN 1 Natar as many as 15 essay items assessed by the observer, then obtained 10 valid items and can be used for science literacy ability tests. In addition it is also used questionnaire responses of learners towards Problem Based Learning which consists of 16 questions, 8 positive statement and 8 negative statement.

The research activity begins with the initial test (pretest) which aims to determine the students' initial abilities before getting the model treatment. Then the learning activities were carried out for 6 meetings in each of the experimental and control classes. After all learning activities have been completed, the next step is to do the final test (posttest) which aims to determine whether the experimental class has better scientific literacy aspects of competency aspects than the control class after being given different treatments in each class. The research activities ended with a questionnaire students ' responses to the Problem Based Learning.

Data analysis used to determine the increase in literacy aspects of attitudes measured, then the calculation of normalized gain score (N-Gain) data was developed by Hake [3] with the following formulations:

$$N - Gain = \frac{\text{postest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}}$$

Obtaining average value N-gain has been obtained k emudian interpreted according to Table 1 below:

Table 1.The Interpretation of the average *n-gain* score

N-Gain Index Range	Category

g <0.30		Low
0.30 <g <0.70		Middle
g> 0.70		High

The acquisition of research data was then statistically analyzed by testing the values of pretest, post-test and N-gain in the experimental class and the control class. Tests carried out in the form of a test for nominity, homogeneity, and t test for all data obtained using the IBM SPSS statistical program 15.

3. Result and Discussions

Aspect of competency is one important aspect of scientific literacy that can be measured.It is because competencyaspects directly related to cognitive outcomes study of students. Aspect of competency has three indicators of achievement, namely scientific issue, describes the phenomenon scientifically and using scientific evidence that can be measured as well. The ability of science literacy aspects of this competency is tested using a descriptive test which amounts to 10 questions in the form of pretest and posttest on the subject matter of environmental change. From the 10 questions, the achievement of indicators of scientific literacy aspects can be measured in detail. This test aims to see an increase in the ability of science literacy competency aspects in experimental and control class students.

The implementation of the PBL model in learning the context of environmental change is expected to improve students' literacy skills because PBL is a learning model that makes practical problems a foothold in the teaching and learning process. The results of the pretest, posttest and N-Gain experiment and control class will be presented to the following Table 2.

Table 2. Results of pretest and posttest experiment class and control class

Value		Average	NT	HT	Hypotesis Test
Pre	E	31.42	0.074	0.481	
	C	32. 52	0.124		
Post	E	71.85	0.072	0.481	0,000
	C	55.39	0.200		
N-Gain	E	0.59			
	C	0.33			

Annotation:
NT : Normality Test
HT : Homogeneity Test
Pre : Pretest
Post : Posttest
E : Experimental Class
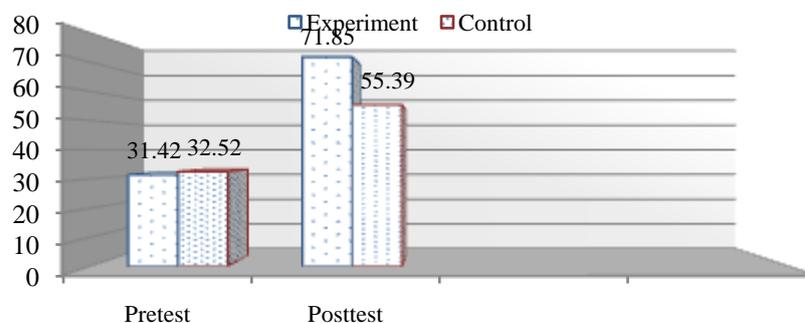C : Control Class

After the pretest and posttest in each class, the results obtained in Table 2. The next test is the normality test to find out whether the data obtained is generated from populations that are normally distributed or not. After the normality test, the next test the homogeneity test was conducted which aims to determine whether a variance (diversity of data) from both groups (experimental and control groups) is homogeneous or not.

The next test of hypothesis by using test Independent sample t-tests were used to find out whether there is influence of learning model Problem Based Learning in the ability of science literacy learnerin experimental class and control class. Based on the table above, the Sig value is obtained (2-tailed) of 0.000 <0.05. Then it can be concluded that there is a significant difference in the average student learning outcomes between the use of Problem Based Learning and conventional learning method. The meaning is rejected and accepted.

In addition, the average N-Gain score of students' scientific literacy skills in the experimental class is higher when compared to the control class which is classified into the medium category for the experimental class and low for the control class. So that it can be concluded that learning by using Problem Based Learning models can influence students' scientific literacy skills on material changes in the environment.
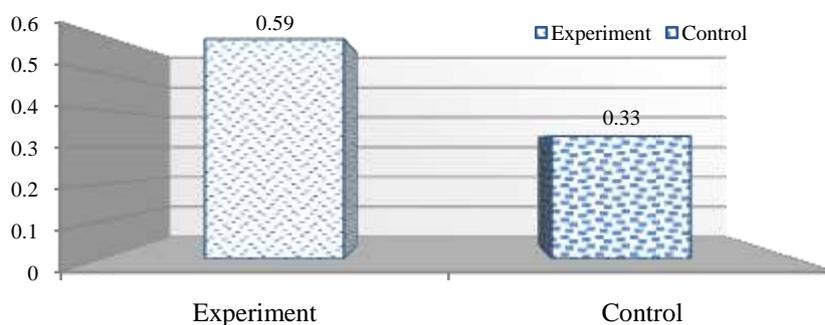
The comparison of the average pretest and posttest scores of the experimental and control classes can be seen in the following figure.

Figure 1. The average value of pretest and posttest for experiment and control class.


Based on the graphic of the score acquisition, there is a more significant increase in the learning outcomes of experimental class students who use the Problem Based Learning model when compared with the learning outcomes of the control class students who use learning with the discussion method. In addition to the results of the learning score, the increase in students' scientific literacy skills can also be seen from the N-Gain score found in the following figure.

Figure 2. The average n-gain of the control class and experiment class

The normal gain value is the difference between the results of the pretest and posttest scores. The N-Gain score test results in the experimental class are 0.59 which are included in the medium category, in the control class 0.33 is included in the low category. Based on the graph, it can be concluded that the increase in students' scientific literacy skills in the experimental class is higher than control class (Figure 2). When viewed from the aspect of competency per indicator, a comparison of the average N-Gain scores of the pretest and posttest can be seen in the following figure.

Figure 5. The average n-gain achievement of science literacy competency indicators
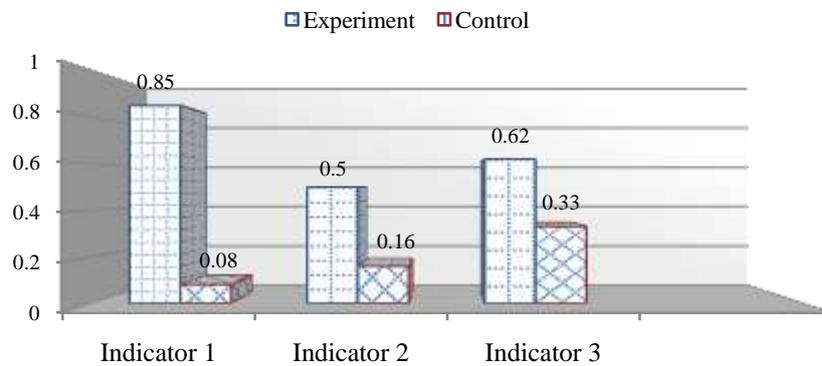
Annotation :
Indicator 1: Identifying scientific issues
Indicator 2: Explain phenomena scientifically
Indicator 3: Using scientific evidence

The N-Gain test aims to see differences in learning outcomes obtained after doing the pretest and posttest in both the experimental class and the control class in the indicators of the PISA competency aspects in detail. From the calculation of N-Gain test scores on the learning outcomes of each of these indicators, it can be determined the level of achievement of the PISA competency aspects which in this case includes 3 indicators regarding environmental change. Based on the graph, it can be concluded that the increase in scientific literacy skills of the experimental class students is higher than the control class in the three indicators of science literacy competency aspects (Figure 5).

The instrument in the form of this response questionnaire was given after students were treated by applying the Problem Based Learning model in the experiment class. Based on students' responses to the learning that has been done in the material environmental changes is very diverse, ranging from positive to negative responses. The description of the results of student responses to the application of the Problem Based Learning model in the experimental class has been presented in the following graph.

Figure 6. Percentage of student responses to problem based learning
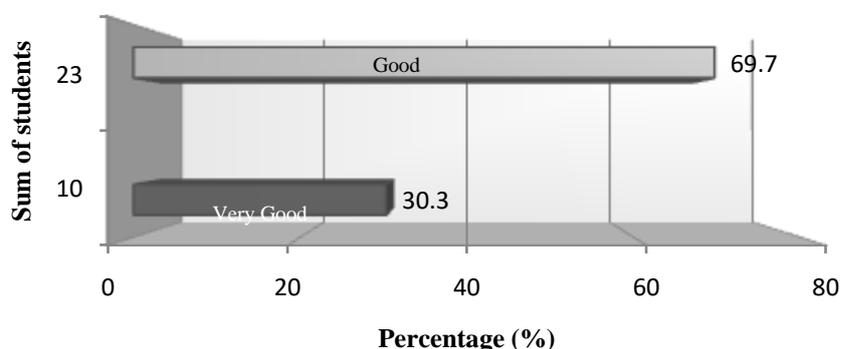
The graph above shows a good responses until very good response from the students to the Problem Based Learning model on the concept of environmental change. The provisions of the categories of students' responses can be seen more clearly in the table. It can be seen in the table that the responses included in the very good category amounted to 30.3% and the responses included in the

good category were 69.7%. So that it can be concluded that this learning model gets a good response from students, especially to be applied to biology learning in the concept of environmental change.

After obtaining the results of the calculation data of the pretest and posttest values in both the experimental class and the control class , it can be concluded that the application of the Problem Based Learning model as a treatment in the experimental class shows an increase in the results of good grades. This is evidenced by the increase in the average value in the experimental class from the results of the pretest test at the beginning of learning and re-tested through posttest at the end of learning. This situation is caused by the difference in treatment between the experimental classes using PBL learning models and control classes that use scientific learning steps. The average results in the experimental class are greater when compared to the control class because PBL learning requires more students to think critically about the problems that are displayed and be able to perform scientific literacy to find solutions to these problems during the teaching and learning activities take place. This is in accordance with the statement of Duch in Shoimin [9] which argues that Problem Based Learning is characterized by real problems as a context for students learning critical thinking and problem solving skills and gaining knowledge.

4. Conclusions

Based on the results of research and discussion, it can be concluded that the *Problem Based Learning* model has a significant effect on improving the scientific literacy skills of students in the material of Environmental Change. The *Problem BasedLearning* can be used as a reference for the biology of learning in the classroom in order to improve scientific literacy.

References

[1]   Al-Farisy, Luqman, B. 2015. Effect of Problem Based Learning Learning Model on Student Biology Learning Outcomes on Virus Concepts . Jakarta : UIN Syarif Hidayatullah..

[2]   Deryati, Putri.2014. " The Effects of Communication Skills on Science Using Multiple Representations Approaches to Learners' Science Literacy " . Journal of Lampung State University. 10 Ibid . h. 12

[3]   Hake, Richard, r. 1999. *Analizing change / score* . (www.physics.indiana.edu), accessed on 5 December 2018.

[4]   Jamil, Nurlaelah. 2017. Effect of Structured Inquiry Learning Model (Structured Inquiry) Against ability SainsPeserta Literacy learners In Mushroom concept . Jakarta : UIN Syarif Hidayatullah.

[5]   Kurniasih, I., & Sani, B. 2014 . *Implementation of the 2013 Curriculum Concept and Application* . Ministry of Education and Culture , 1–162.

[6]   Organization for Economic Cooperation and Development (OECD). 2013. PISA 2012 Assessment and analytical Framework: mathematics, reading, science, problemsolving, and financial literacy [Online]. Available: http://www.keepeek.com/Digital Assetframework_9789264190511-en (4January 2019) .

[7]   Organization for Economic Cooperation and Development (OECD) .2015 , PISA 2015. Item Submission Guidelines: Scientific Literacy . Oecd.org accessed December 5, 2018) .

[8]   Organization for Economic Cooperation and Development (OECD). 2014. *PISA 2012 Result: What Student Know and Can D o: Student Performance in Mathematics, Reading and Science* [Revised edition October 2018]. 1: 232 .

[9]   Shoimin, Aris. 2014. 68 Innovative Learning Models in 2013 Curriculum. Yogyakarta : Ar-Ruzz Media.

[10]   Toharudin, U., Hendrawati, S., & Rustaman, A. 2011 . *Building Science Literacy Participants Learn.* Bandung: Humanities.