

Effectiveness Worksheet of The Global Warming Based on Problem to Improve Students Science Literacy

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Abstract. The purpose of this research were to describe the effectiveness of learning used worksheet based on problem to increase students science literacy about global warming. The research method used a quasi experiment using pretest-posttest design. This research involved 71 respondents from class VIIa dan VIIb who were taken by purposive sampling technique from seven grade students of SMP N 7 Kotabumi Lampung. Questionnaires and tests was applied in this research to collect the instrument of the data. The data was analyzed by using paired sample t-test to see the effectiveness of student's learning in both groups of the sample. The result showed the significant differences between the average score of science literacy skill in the first experimental class and also in the second experimental class, beside that the effectiveness also could be seen from the effect of size. The value of effect size 0.96 (large category) in first exeperimental class and 0.95 (large category) for second experimental class and the ability of science literacy in first experimental class obtained an average of n-gain of 0.77 (high category) and second experimental class obtained n-gain average of 0.76 (high category). Furthermore, the students showed a good response to learning the material by using worksheet based on problem.

INTRODUCTION

Science education demands scientific skills and skills to deal with the times and technological advances [1]. The ability of the student in mastery of science in a learning process is often termed a literacy ability of science [2]. Many studies focus on science literacy especially sains. The study provides information that the literacy ability of Indonesian students is still low. The research that has been done related to students' science literacy capability is research from Odja and Payu [3] research stated that the initial ability of science literacy of students consisting of four categories namely nominal, functional, procedural and multidimensional still on the low categories.

Those research showed that science learning in Indonesia is still not able properly to train students' science literacy skills. This fact is reinforced by the results of Program for International Student Assessment (PISA) in 2015 report on science literacy, showing that Indonesia can only rank 66 out of 72 countries with a score of 403 below the average PISA, which score of 500 [4]. The low achievement of Indonesian students in PISA is a reflection of the unsuccessful learning of science and the low level of the student science literacy. The low achievement of science literacy in Indonesia according to Retmana [5] showed the weaknesses of the students' understanding of the basic concepts of science that have been taught, so they can not apply it to interpret the data, explain casual relationships, solve simple problems though and the limitations of students' mind in the form of writing. Based on the statement above, the low literacy skill of Indonesian students influenced by many things, such as curriculum and education system, the selection of teaching methods and models by teachers, learning facilities and facilities, learning resources and teaching materials [2].

Chosen of learning models and teaching materials that not accurately can affect the student achievement and one of the solutions to overcome the low literacy of science is to use problem-based learning model (PBL) [6], [7], [8], [9]. Because the PBL model is a learning model that exposes students to authentic problems so students can build their own knowledge, foster higher science skills, establish students and increase self-confidence [10]. In addition, problem-based learning requires students to actively explore their own knowledge through problem [11]. PBL also enable to the students to find the relevance and enjoy their knowledge, enhance their creative capacity and responsibility in solving real-world problems [12].

Beside the learning model, another aspect which is concerned in overcoming the low literacy of science students is the presence of learning resources (worksheet). Based on the survey results in 11 junior high school in Lampung Province it is known that worksheet used by the teachers in learning has not been able to build students' science literacy skills. Worksheet used also do not train much ability of higher thinking and student activity. Actually worksheet is one of the most important ingredients to achieve the objectives of the activity [13]. By worksheet, students should be able to enjoy their learning activities. Worksheet can be used for long-term studies to determine their effectiveness on students' affective behaviors[14]. In line with the statement above, Töman, et al. [15] stated that worksheet is more activate students and can increase successful in their study. This is consistent with the fact that the behavior of individuals learning with worksheet is more effective than those who only learn by hearing or seeing.

Based on the researchs above, the researcher intendt to research the worksheet that based on the problem expected to be a solution to improve students' science literacy. Worksheet that based on the problem is a worksheet designed by following PBL syntax. This is supported by Swan et al. [16] which provides an empirical theoretical and grounding ground for using the PBL and the Preparation for Future Learning (PFL) framework, which is the preparation of future studies, especially as a basis for developing teaching materials that use real data or facts to generate literacy students. Increasing understanding through the PBL model will enable us to adjust the development of curricular and related curriculum materials by emphasizing the importance of PFL, the learning cycle, and the role of teachers in educating high school students about data literacy in a relevant and meaningful way. The material of global warming was chosen as the theme of students' learning in this research, it is caused a global warming is a theme that closely related to their daily life and its impact caused many problems and affect the environment and daily life, so it could be appropriate if the learning process using worksheet based on problem.

Based on the description of the background can be formulated problems in this research is how the effectiveness of worksheet based on problem to increase science literacy on global warming material.

EXPERIMENTAL

Research Design

This research was conducted at SMP N 7 Kotabumi, North Lampung Regency. The research method used a quasi experimental with pretest-posttest design [17] as presented in Table 1.

Table 1. Pretes-Postest Design

Kelas	<i>Pretest</i>	Perlakuan	<i>Posttest</i>
VIII A	O ₁	X	O ₂
VIII D	O ₁	X	O ₂

Description: O1 is pretes, X is learning using worksheet based on problem, and O2 is postes.

Population and Sample of Research`

Population in this research were all student of class VII of academic year 2017/2018 SMP N 7 Kotabumi Lampung with 255 students and the sample of this research were 71 students from class VIIa as first experimental class and class VIIb as second experimental class 2. The sample of the research was obtained by purposive sampling technique.

Instrument

The instrument of data collection in this research was used interview, questioner and test. The structure of the interviews were given to the science teachers at 11 schools in Lampung Province to find out the teaching materials that used in classroom learning. The questionnaires were given to find out the students' responses to learning using worksheet based on problem. The tests were conducted to determine the students' literacy skills, which were given when the first lesson (pretest) and the end of the third meeting (postes) were attended. The instrument of the test was measured by the expert to determine the level of validity and reliability before those test distribute to the students.

Data Analyzing

The data of the students science literacy ability was obtained from the pretest and posttest values in the analysis with prerequisite test in the form of normality test. If the data is normally distributed then t test the difference of two averages (paired sample t-test). Once the value of t is known then the value of the effect size would be searched. In addition, the effect size of learning effectiveness also seen from the value of N-gain in experimental class 1 (VIIa) and experimental class 2 (VIIb) by using the formula:

$$g = \frac{S_{post} - S_{pre}}{S_{max} - S_{pre}} \quad [18].$$

Description: g = average N-gain S_{pos} = average postes score

S_{pre} = average prax score S_{max} = maximum score

N-gain criteria: high if $g > 0.7$, mean if $0.7 > g > 0.3$ and low if $g < 0.3$

To determine the magnitude of the differences between the value of pretest in experimental class 1 posttes and experimental class 2 then the effect size were calculated. The effect size is important to know, because it can inform the size of the impact [19]. To calculate the effect size using the following formula of Abu Jahjough [20].

$$\eta^2 = \frac{T^2}{T^2 + df} \quad [20].$$

Description: η^2 = Effect size (effect size) T^2 = value of t pretes and postes

df = degrees of freedom

Then categorize the effect size using the standard Cohen criteria as follows :

Table 2. *Effect size category*

<i>Cohen's Standard</i>	<i>Effect Size</i>	<i>Percentile Standing</i>	<i>Percent of Nonoverlap</i>
<i>Large</i>	0,6-2,0	73-97,7	47,4-81,1
<i>Medium</i>	0,3-0,5	62-69	21,3-33,0
<i>Small</i>	0,0-0,2	50-58	0-14,7

[21].

Student response data obtained from questionnaire response to learning using worksheet based on problem then analyzed descriptively.

RESULTS AND DISCUSSION

The result of the data analysis showed that the worksheet based on problem effectively improve the students' literacy ability of science, it could be seen from the the significant differences between the mean of pretest value and the posttest of science literacy of the students in the experimental class 1 and the experimental class 2 (Figure 1).

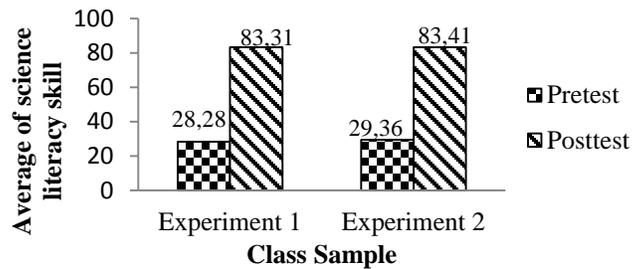


Figure 1. Average pretest and postes of science literacy in experiment class 1 and experiment 2

Figure 1 showed that both in first experiment class and second experimen class, there was a significant differences between the mean pretest value and posttest of science literacy. To find out the magnitude of science literacy capability improvement in first experiment class and second experiment class, it is necessary to calculate n-gain. The competence of science literacy which become factor in this research include indicator explain scientific phenomenon, interpret data and scientific evidence and draw conclusion. The competencies were tested in the form of pretest / postes questions given to the students. Based on the calculation of n-gain, the ability of science literacy in first experiment class obtained an average of n-gain of 0.77 (high category) and second experiment class obtained n-gain average of 0.76 (high category). The high N-gain values in both classes reflect the success of learning. Learning is done by conducting an investigation [22] and in groups so that in the end learning can build high-order thinking skills [23]. Learning using worksheet based on problem raises the phenomenon of contextual problems so that it can provide instructional impact and impact of the accompanist on the development of students' thinking ability [24]. Furthermore, the average n-gain for each aspect of the science literacy indicator in first experiment class and second experiment class is shown in Figure 2.

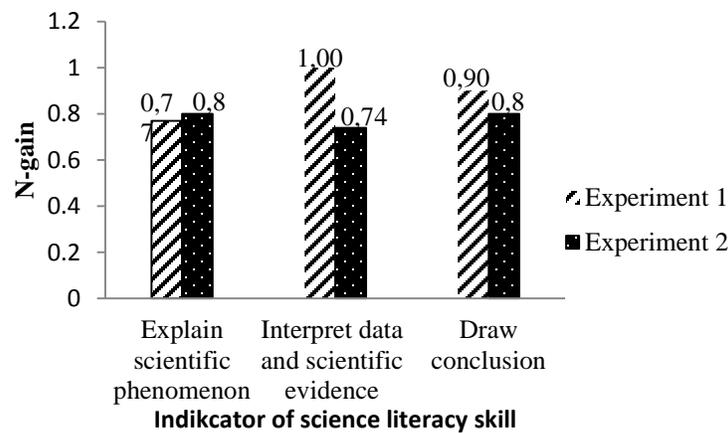


Figure 2. Average for each competence indicator of science literacy.

Figure 2 shows that science literacy indicators that have the highest increase are indicators of data interpretation and scientific evidence. All indicators in the first experiment class and second experimen class have n-gain above 0.7 which means that the increase is high. The increase is due to the learning of students trained to think and solve problems and more active in learning [25]. Then, to know the effect of the impact of the use of worksheet based on problem to increase the ability of science literacy in experimental class 1 and ekeperimen 2 class do the effect size calculation. According to Sullivan and Fein [19] effect size is important to look for because it can inform the size of the impact. Based on the calculation result, the value of effect size 0, 96 (large category) in experimen 1 and 0.95 (category large) for experimen class 2 (Figure 3).

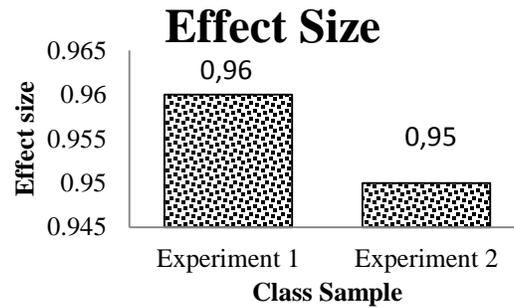


Figure 3. Effect size of experiment class 1 and experiment class 2

Based on Figure 3 showed that the learning process in the first experiment class influenced by 96% by the use of worksheet based on problem, some as in the second experiment class where the learning process influenced 95% by the use of worksheet based on problem on the above calculation, it is known that in the first experiment class and second experimental class, the use of worksheet based on problem could be said had a big effect on the increase of students science literacy. The differences in effect size on first experiment class and second experiment class occurred because of the differences in teacher teaching, where the teacher's knowledge of literacy is lacking. This is consistent with Astuti et.al [26] that teacher knowledge about science literacy is still very limited so that its application in learning is not maximal. The differences in teaching delivery also influenced learning achievement [2] although in this case the effect size in the two classes does not significantly different.

The success of worksheet based on problem in improving the three competencies of science literacy indicator is due to the fact that in the student learning questions that refer to the science literacy indicator, worksheet based on problem allows the students to explore the problem analysis and problem-solving skills. worksheet based on problem was made by following PBL model syntax which makes the students build their own understanding through phenomenon of the problem at worksheet that guides the students to construct their own knowledge to solve the problem. This makes the students more enthusiastic and active in learning. This is in accordance with the statement of Redshaw and Frampton [27] PBL model Encourage the development of students' thinking and communication as well as a learning approach in which students are responsible for building their activities. In addition Abdurrahman [28] stated that good worksheet affect the learning activities and impact there is the end goal of learning and help students in achieving learning objectives.

After learning using worksheet based on problem, students were given a questionnaire and asked to provide the feedback on the on going learning. Based on the results, the students calculations give a positive response to learning. In general, students' response to learning using worksheet based on the problem could be seen in Table 3.

Table 3. Percentage of students response to learning outcomes in the experimental class1 and experimental class 2.

No	Student Respon:	Percentage	Categories
1.	Experiment 1	100 %	Very high
2.	Experiment 2	99 %	Very high

Based on Table 3, it is known that students provide a good repons using worksheet based on problem in learning. All the students argue that global warming material learning becomes more interesting, fun, and students find it easier to understand the material because of the phenomenon of problems that exist in contextual worksheet with the life of everyday students. Besides feat, the students also agree that the presentation aspect of the material is easy to understand and the language used is easy to understand. This is consistent with the statement of Tasdelen and Koseaglu [29] which says a textual material is said to be good if it gets a positive response from students regarding aspects of attractiveness, the extent to which help students and how easy to be understood by students

The results of student responses to learning using worksheet based on problem on very high categorized and result calculation effect size also on large categorized. This shows that the worksheet based on problem is effective for improving students' science literacy.

CONCLUSION

Based on the results of the data analysis, it could be concluded that the worksheet based on the problem effectively improved the ability of science literacy. It could be seen from the differences between the average values of the pretest and posttest scores in first experiment class and in second experiment class, in addition the effectiveness also could be seen from the effect size and N-gain value is high. Furthermore, the students give a good response to learning by using worksheet based on problem.

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