

Effectiveness of Ecology and Environment Textbook Based on Science Literacy and North Sumatra's Local Potency to Improve High School Student Science Literacy

Ivandi Sitompul
Biology Education
State University of Medan
Medan, Indonesia
Van_tompul@yahoo.com

Binari Manurung
Biology Education
State University of Medan
Medan, Indonesia

Rahmad Mulyana
Biology Education
State University of Medan
Medan, Indonesia

Abstract—This study was held to determined: 1) Effectiveness of learning by using Ecology and environment textbook based on science literacy and local potency of North Sumatra in ten grade of Markus High School and Free Methodist High School. (2) Ten grader student's science literacy after using ecology and environment textbook based on science literacy and North Sumatra's local potency and students using textbooks in Markus High School and Free Methodist High School. This research was quasi experiment with two class served as sample which taken by *cluster random sampling*. The first class (X-1) was taught by using student biology handbook and the other class (X-1) was taught by using ecology and environment textbook based on science literacy and North Sumatra's local potency. The instrument used was science literacy test which contain an essay test, multiple choices test and observation sheet. Data analysis technique was by t test at significant level of $\alpha = 0,05$, using *SPSS 22.0*. The result showed there was a significant effectiveness differences in class taught by using ecology and environment textbook based on science literacy and North Sumatra's local potency ($N\text{-gain} = 0,65$, and $\bar{X} \pm SD = 79,86 \pm 4,21$) with the class taught by using student's original biology handbook ($N\text{-gain} = 0,4$, and $\bar{X} \pm SD = 68,01 \pm 5,71$) and t test result obtained was $t_{\text{count}} = 10,456$; $P = 0,00$. As a follow up this result, it is suggested that teacher used this ecology and environment textbook based on science literacy and North Sumatra's local potency as an effort in improving student's science literacy

Keywords— *Ecology and environment textbook based on science literacy and North Sumatra's local potency; Student's biology textbook; effectiveness; student's science literacy*

I. INTRODUCTION

Biology learning is expected to improve national development, especially to improve the quality of education in Indonesia. The Indonesian Nation's education quality index can be seen from the Program for International Student

Assessment (PISA 2015 which focuses on mathematics, reading, and science).

Based on the results of tests and evaluations regarding the level of education in Indonesia organized by the OECD (Organization for Economic Cooperation and Development) in 2015, the performance of Indonesian students was still relatively low. The average score of achievement of Indonesian students for science, reading, and mathematics was ranked 62, 61, and 63, respectively of the 69 countries evaluated.

Looking at those data, improvement literacy in the field of science is very necessary, as emphasized by Sarkar (2012) that science literacy is recognized as the need of all students who not only depend on the future of their learning but also their career aspirations.

The low score of Indonesian students science literacy raises many questions related to its causal factors. One of the factors that influence student's low science literacy is the selection of learning resources, such as books. This statement is in line with the results of the study by Eko Hariadi (2009) which states that one of the factors that lead to student's low science literacy and directly related to students is a learning resources, both from textbooks and from other sources.

Based on observations made at Markus High School, it was known that textbook used have not demand students to develop science literacy. There was also the imbalance in science literacy in student textbooks, especially in class XI in Markus High School in Medan and was evidenced by the score of student learning outcomes in Biology. This situation was proven by looking from student learning outcomes that have not been maximal, especially in Environmental Management topic. Only 40.3% of students passed the test, while the remaining 50.7% are not or are still below the

minimum standard score, which is 70. This low learning outcome of biology was indicator of the lack of success in learning activities.

Based on book development research conducted by Haloho (2016), ecology and environment books based on science literacy and Sumatra's local potency was possible to be implemented because it was based on conditions that are familiar with the life of students which can improve student's science literacy skills and science process skills. However, this book has never been tested to find out its effectiveness.

II. RESEARCH METHOD

This research was a pseudo quasi-experiment. The design of the study was a *pretest-posttest control group design*. The population in this study was all tenth grader students of Markus e High School and Free Methodist High School in Medan. The sampling technique was cluster random sampling. Two classes were taken as sample with class X-1 was given treatment with learning by using student original biology textbook (control), and class X-2 was taught learning by using ecology and environment textbook based on science literacy and local potency of North Sumatera (experiment).

The independent variables in this research were ecology and environment textbook based on science literacy and local potency of North Sumatera and student's biology textbook. The dependent variable was student's science literacy based on science as a body of knowledge, science as a way of investigating, science as a way of thinking, and the interaction among science, technology, and society.

In this research, data collection technique to measure science literacy as a body of knowledge was made in form of multiple choices, observation sheet was used to measure science literacy as a way of investigating, higher order thinking test according to Bloom's taxonomy was used to measure science literacy as a way of thinking, and an essay test was used to measure science as the interaction among science, technology, and society. Tests were held to times, which are pretest, to find out student's initial knowledge and posttest to measure students science literacy skills. Data analysis technique used was *independent sample t test*.

This research used N-Gain test to find out the effectiveness of using ecology and environment textbook based on science literacy and North Sumatera's local potency and student's original biology textbook. N-gain test calculation was done by finding out the difference between pretest and posttest scores, divided by ideal score, and then subtract with pretest score. Interpretation of N-gain result were high category (very Effective) = $g < 0,7$; medium category (Effective) = $0,3 \leq g \leq 0,7$; and low category (not effective) = $g < 0,3$. (Meltzer, 2002).

III. RESEARCH RESULTS

Index Gain calculation aimed to determine the improvement of learning outcomes and to measure

effectiveness level. Interpretation of N-gain result were high category (very Effective) = $g < 0,7$; medium category (Effective) = $0,3 \leq g \leq 0,7$; and low category (not effective) = $g < 0,3$. (Meltzer, 2002).

TABLE 1. N-GAIN TEST RESULT OF CONTROL AND EXPERIMENT CLASSES IN EACH ASPECT OF SCIENCE LITERACY IN MARKUS HIGH SCHOOL AND FREE METHODIST HIGH SCHOOL

No.	School name	Experiment		N-GAIN	Control		N-GAIN
		Pre Test	Post Test		Pre Test	Post Test	
1	Markus high school and Free Methodist High school	46,2	79,86	0,65	47,675	68,01	0,4

According to table 1. above, It can be proven that the use of Ecology and Environmental Textbook Based on Science Literacy and North Sumatera Local Potency for the experimental class was very significant in improving student achievement in ecological and environmental teaching, compared to original biology textbooks used in the control class. This can be seen through the result of N-GAIN test of high school students in the experimental class higher than the control class in each aspect of literacy. The average Gain value of the two groups entered into the medium criteria, but if viewed based on the N-Gain value, it can be seen that the N-Gain experimental group was higher than the control group. This shows that the Ecology and Environmental Textbook Based on Science Literacy and North Sumatera Local Potency have higher effectiveness when compared to Student original biology textbooks.

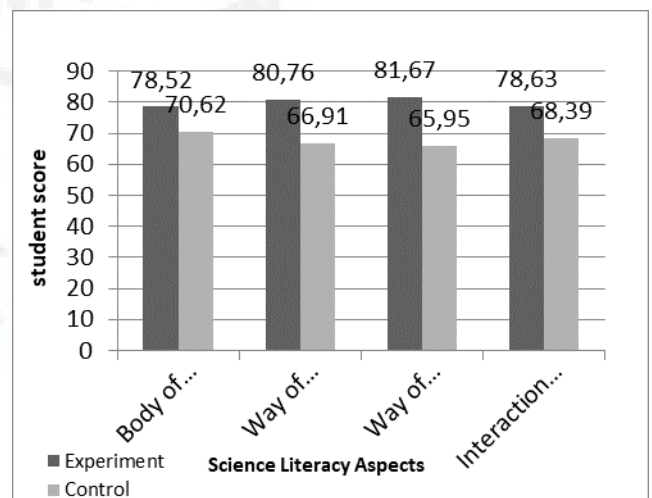


Fig. 1. The posttest scores of students

Based on the description of student achievement above in Fig. 1, it was found that the posttest scores of students in the experimental class was higher than in the control class in all aspects of literacy. Basically, the teaching and learning process in the experimental class used standard ecology and environment textbook based on science literacy and local potency of North Sumatra, but the control class only used student textbooks from school.

The result that obtained from calculation of the independent sample t-test is shown in Table II.

TABLE II. SUMMARY OF HYPOTHESIS TEST CALCULATIONS

Schools	treatments	Data	Average score	T _{count}	t _{table}	Sig : p	Summary	
Markus high school and Free Methodist High school	Experiment	Science literacy posttest	79,86	10,456	2,042	0,00	Hypothesis	H ₁ accepted
	Control		68,01					

One sample t-test was done to test the hypothesis by using posttest score. Based on table 2 above, the result obtained was $p < 0,05$, which means H_0 rejected and H_1 accepted. This result indicated students taught by using ecology and environment textbook based on science literacy and local potency of North Sumatra have higher average score of learning outcome compared to the other book in ecosystem topic in both schools.

IV. DISCUSSION

The main goal of learning Science is the achievement of scientific literacy. The instructional materials prepared should provide opportunities for students to be able to develop several skills, such as process skills, thinking skills, and scientific literacy skills (Toharudin, 2011).

The results of the effectiveness test of Ecology and Environmental Textbook Based on Science Literacy and North Sumatra's Local Potency in the experiment class showed that Ecology and Environmental Textbook Based on Science Literacy and North Sumatra's Local Potency was very good to use.

It is effective because this Ecology and Environmental Textbook Based on Science Literacy and North Sumatra's Local Potency raises some of North Sumatra's local potential which contains activities that can develop students' abilities in scientific literacy, namely scientific inquiry, awareness of the science and technology to form a material, intellectual and culture, and the desire to be involved. This activities are packaged in a book module with its conceptual explanation. It aims to enable students to hone their science literacy.

This is in accordance with the research of Manurung et al., (2017), that Ecology and Environmental Books Based on

Science Literacy and Sumatra Local Potency are feasible to implement because they are based on conditions that are familiar with the lives of students which can improve student's science literacy skills and science process skills. Where the content feasibility based on science as a body of knowledge has an average score of 93.75% (very good), while science as a way of investigating 87.50% (very good), science as a way of thinking was 95.31% (very good), science as the interaction between science, technology and society was 92.50% (very good). Assessment of the feasibility of teaching material design based on design experts is also very good with a percentage score of 91.43%. The results of the biology teacher's assessment of the learning material on ecology and environmental science-based topics was 93.75% (very good). Student responses to initial field testing in individual testing was 80.35% (good), small group trials was 84.52% (very good) and large-scale groups was 91.38% (very good).

The difference in learning outcomes between the experimental class and the control class was also caused by the use of student textbooks made by publishers so that they were not in accordance with the needs of students, while the Ecology and Environmental book used in the experimental class were in accordance with student's needs because they use local potency in North Sumatra as a tool learn.

Besides influenced by teaching materials, learning success is also influenced by learning methods and strategies. The difference in treatment of the control class and experimental class is only found in the use of teaching materials. In the learning process, both classes use the same learning strategy, that was guided discovery and discussion. This learning strategy was chosen based on the suitability of the learning process in the curriculum applied in the school where the research was held, which was *KTSP*, where students were given the freedom to explore themselves first. The teacher was only served as facilitator who justifies if there was a misunderstanding in the concept. In addition, learning strategies that begin with reading if combined with science-based teaching materials will have a positive impact on student learning outcomes. This is in line with the results of research conducted by Taslidere and Eryilmaz (2010), that integration of reading strategies and the use of science literacy teaching materials will have a significant positive effect on improving student's cognitive learning outcomes compared with other learning strategies and methods.

V. CONCLUSIONS

Based on research result and discussion that has been described, it could be concluded that: there was significant differences of science literacy learning outcome between students taught by using media of Ecology and Environmental Textbook Based on Science Literacy and North Sumatra's Local Potency with students whom are taught by using original biology textbook in Ecology and environment topic di tenth grade of Markus high school and Free Methodist High school.

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