

Scientific Literacy Skill of Junior High School Student Using Ethnoscience Based Learning

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Abstract—The challenge of education in Indonesia today is to guide students into a literate generation, a generation that is sensitive and concerned about the environment and issues that are happening. To be a human who has good information literacy, all we needs to be done is reading habits. Permendikbud No 23 of 2015 on the Cultivation of Character reinforces the effort to establish the culture of literacy. One effort that can be done is to develop teaching material that have the goal to increase scientific literacy. In order to make students more interesting, the learning tool is integrated with ethnoscience Batik. The material that is integrated with ethnoscience Batik is “Classification of Matter”. The development model is used 4D Model from Thiagarajan. The limited trial was conducted for 15 student of grade VII-SMPN 1 Bandung, Tulungagung get the result obtained were the average n-gain of students of 0.56 in the medium category. The results of questionnaire responses indicate that the students scientific attitude could increase as well as learning activities get positive response.

Keywords—Batik, ethnoscience, scientific literacy, teaching material

I. INTRODUCTION

Education has a close connection with the culture of a nation. Through the education, moral values and national excellence in the past can be reintroduced, developed and studied into an acceptable culture in the present era where students live and develop themselves [1]. In the present, culture can be integrated into students learning at school, especially science lessons [2]. Science is seen as a set of knowledge, that the result of research was able to be arranged systematically into a knowledge grouped according to the study fields, such as physics, biology, and chemistry. Meanwhile, science is referred to as a method of inquiry which means that science provides illustrations or descriptions of the approaches used in the preparation of knowledge [3].

The implementation of the Curriculum 2013 which has been applied in the world of education certainly has great hopes for the advancement of education in Indonesia. Curriculum 2013 teaches students to learn more critically and actively in searching information, explaining a phenomenon, and providing solutions to a problem. Such learning will be more effective if students have the provision of literacy skill [4]. In fact, scientific literacy of Indonesian students in the PISA 2015 assessment was still at level 2 or remain below average. Therefore, its need a learning that can further enhance students scientific literacy. Scientific literacy

is very useful because it will be help students to identify problems and draw conclusions based on evidance [5].

The school that are able to become the front line in developing a culture of scientific literacy, according to Beers [6] must have positive strategies such as conditioning the environment of friendly literary, seeking a social and affective environment as a literacy model of communication and interaction, and striving for school as a literat academic environment. Based on interviews with one of the science teacher in SMPN 1 Bandung, Tulungagung, the reality was found that reading habits 15 minutes before learning had not been able to be carried out in a structured and constant manner. The habitual of literacy attitude do require support from all school residents. If there is an imbalance, so that the learning process cannot run smoothly.

One way that can be used to increase scientific literacy skill of students is by integrating ethnoscience or local wisdom into learning materials. Ethnoscience comes from the word “ethnos” which means nation and “scientia” which means knowledge. The function of ethnoscience is will ease students to explore the facts and phenomenon that exist in society and be integrated with scientific knowledge [7]. Ethnoscience can attract students interest in learning because its related to their own regional identity. In addition, ethnoscience can foster a sense of awe with regional culture and preserve it.

Learning at the integrated science applied at this time aims to introduce various advantages around certain regions. Scientific explanations about cultural phenomenon around students can help understand the surrounding environment and whats learned in school. Ethnoscience which is rooted in the lives of students is a form of contextual experience [2]. The important concepts that exist in learning materials can be related to ethnoscience is clasifications of material. But in general, ethnoscience based learning to increase scientific literacy skill is still rare in Indonesia. Therefore, researcher will be develop the teaching material based on ethnoscience Batik to increase scientific literacy at junior high school level. Batik can be integrated into science learning because the materials used for Batik are composed of elements, compounds, and mixtures. The process of Batik using batik wax and batik coloring process is related to changes in physics and chemistry. Liquid waste produced by Batik process can be clarified by studying the separation of the mixture.

II. METHOD

A. Research Procedure

The research procedure is divided into two phase, that are the preparation of teaching material and the limited testing phase. The teaching material development used 4D model from Thiagarajan. 4D model consists of 4 stages that are define, design, develop, and disseminate. In the define phase, the things that must be done are “front-end-analysis” consist of curriculum analysis, analysis of relevant learning theories, and challenges in the future. Then, the analysis of students consist of an analysis of academic ability and maturity level. Analysis of material and task are carried out to identify the material and tasks thoroughly [8].

The second phase is design phase. The phase that must be done in design are doing preparation of literacy tests assessment, media selection, and preparation of teaching material that are consist of Learning Implementation Plan, Textbook, Student Activity Sheets (SAS), and Scientific Literacy Tests Assessment Instrument. The result of the drafting at the design phase resulted in an initial draft called draft I. The third phase – develop phase, activities that must be done are review the teaching material, validate the teaching material by validators, conduct a limited trial, and analyze the result of the trial. If the result of the analysis are practical and effective, then a broad trial can be distributed.

B. Research Instruments

Research instruments are a tool to collect the research data. The instruments that used to determine the effectiveness of teaching material consist of scientific literacy test instrument and student questionnaire responses. The literacy test instrument were used to determine the scores of students scientific literacy skill – before and after the learning – used teaching material based on ethnoscience Batik. The test of scientific literacy was used at the pretest and posttest. Students questionnaire responses instrument was used to determine students opinions or responses to teaching material develop and the application.

C. Data Analysis Techniques

The scientific literacy test needs to be measured in sensitivity to find out how well the item was used. The sensitivity of the item is measured using the following formula:

$$S = \frac{RA - RB}{T}$$

Explanation:

- S = Sensitivity of the item
 RA = Quantity of students who answered correctly in the final test (posttest)
 RB = Quantity of students who answered correctly in the pretest
 T = Quantity of all students taking the test

The question is declared sensitive if the item is worth 0.30 – 1.00. The literacy test item that have been used has a tendency of sensitivity of 0.33, so that the items developed were declared sensitive or worthy to used.

In this research, 15 items of literacy tests and 7 scientific attitude questionnaires were used. The scientific literacy test analysis is carried out in the following ways:

a) Analysis of domain knowledge, context, and competence

Scientific literacy skill scores are handle using scores of learning outcomes as in the formula below:

$$\text{Completeness Indicator} = \frac{\sum \text{the question answered correctly}}{\sum \text{all questions}} \times 100$$

Based on this formula, students who get a score ≥ 70 are declared complete. The result of pretest and posttest will be analyze use n-gain to see the improvement of scientific literacy. The formula for determining n-gain is as follows:

$$\text{N-gain} = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}}$$

Category of acquisition criteria N-Gain scores can be seen base on the Table 1.

TABLE 1. N-GAIN CRITERIA

Normalized Gain	Category
$g < 0.30$	Low
$0.31 < 0.70$	Medium
$g > 0.71$	High

b) Scientific Attitude Analysis

Analyze data of scientific attitudes was done by quantitative descriptive in the form of a Likert scale. The response to each statement was stated in 4 categories: Very Interesting (VI), Interesting (I), Less Interesting (LI), and Not Interesting (NI). The values in each category are: VI = 4; I = 3; LI = 2; NI = 1. The assessment that used as a whole using percentages (%) as follows:

$$\text{Scientific Attitude} = \frac{\text{Highest score} \times \text{total score obtained}}{\text{Highest score} \times \text{all respondents}} \times 100$$

Interpretation criteria scores from the attitude domain are present in Table 2.

TABLE 2. INTERPRETATION OF ATTITUDE DOMAIN SCORES

Percentage (%)	Category
0 – 20	Very Less
21 – 40	Less
41 – 60	Enough
61 – 80	Good
81 – 100	Very Good

c) Students Responses Analysis

Students responses can be calculate use the following formula:

$$P = \frac{\sum X}{\sum N} \times 100\%$$

Explanation:

P = Percentage of student responses

$\sum K$ = Quantity of students responding

$\sum N$ = All students

The percentage of responses from students can be converted based on the criteria in Table 3.

TABLE 3. INTERPRETATION CRITERIA

Percentage (%)	Category
0- 20	Very Weak
21-40	Weak
41- 60	Enough
61- 80	Good
81- 100	Very Strong

III. RESULT AND DISCUSSION

The effectiveness of learning material is seen from the result of scientific literacy tests and students responses to the learning that has been done. Scores of scientific literacy of students in this research were handled as an assessment of learning outcomes. The assessment was done twice, used pretest and posttest. The measured scientific literacy skill cover by four aspects, that are aspects of knowledge, aspects of competence or process, aspect of the context of science, and aspects of scientific attitudes. Scientific literacy indicators that were used consist of: (1) indentifying scientific facts or phenomena; (2) analyzing scientific evidence or scientific phenomena related to the environment and scientific research; and (3) using evidence or scientific research to formulate problems, make hypotheses and conclusions.

Pretest is given to measure the extent of student scientific literacy skill before the learning process is carried out. Then, to find out the effect of the treatment or learning provided, the posttest was done. The time that given to work on 15 test of scientific literacy is 40 minutes or 1 hour lesson plan and 20 minutes for student response questionnaires. Scientific literacy tests and response questionnaires were carried out outside of study hours/ treatment, so it will not confiscate or reduce the required learning time. The results of pretest and posttest scientific literacy are shown in Table 4.

TABLE 4. PRETEST-POSTTEST RESULT OF SCIENTIFIC LITERACY

No.	Student Code	Value of		N-Gain	Category
		Pretest	Posttest		
1.	RTY	33.33	73.33	0.60	Medium
2.	AS	46.67	80.00	0.62	Medium
3.	ANZI	20.00	80.00	0.75	High
4.	MBM	13.33	66.67	0.61	Medium
5.	SN	46.67	66.67	0.37	Medium
6.	DP	46.67	73.33	0.50	Medium
7.	WED	53.33	80.00	0.57	Medium
8.	FDS	40.00	73.33	0.55	Medium
9.	RS	46.67	73.33	0.50	Medium
10.	SZH	53.33	80.00	0.57	Medium
11.	ER	53.33	73.33	0.43	Medium
12.	GDA	26.67	73.33	0.63	Medium
13.	APA	46.67	73.33	0.50	Medium

No.	Student Code	Value of		N-Gain	Category
		Pretest	Posttest		
14.	YFA	33.33	73.33	0.60	Medium
15.	ACK	40.00	80.00	0.67	Medium
Average		40.00	74.66	0.56	Medium

Based on Table 4 above, it was found that there was an increase in scientific literacy scores from pretest to posttest. The average students score is categorized as moderate with an n-gain value of $0.30 < g < 0.70$ [9]. N-Gain obtained is 0.56 in the medium category. Each question has a tendency of a sensitivity value of 0.33 with a sensitive category and can be used to measure scientific literacy. Based on the results of pretest and posttest, it was obtained data that some students did not correctly answer the questions on aspects competence or process and context. As Liu [10] has stated that scientific literacy is not an easy thing, so scientific literacy can be trained by not only reading a lot, but also understanding the concept of reading that is read and developing new knowledge.

The importance of scientific literacy taught in the world of education is that literacy of science is an important part of human culture and is one of the culmination of human thinking skills; scientific literacy is a common experience laboratory for language development, logic, and problem solving skills in the classroom; democracy demands its citizens to be able to make personal and community decisions where scientific information plays a fundamental role, and therefore requires scientific knowledge and understanding of scientific methodologies; and to foster lifelong learning habits and preferences for students [11]. Based on the result obtained, the method used to further improve students literacy skills is by perfecting the steps of learning activities, making the classroom atmosphere that attracts students attention to learning, and providing scientific literacy practice questions that refer to PISA sources or others.

Scientific literacy assessment can also be seen from students scientific attitudes. There are 7 points of scientific attitude to know the extent to which students have an attitude of caring about science, surrounding phenomena and the environment. The following is present the result of the students attitude questionnaire on the Table 5.

TABLE 5. AVERAGE OF PRETEST-POSTTEST DOMAIN ATTITUDE SCIENTIFIC LITERACY

No.	Results	Average Response Attitude (%)			
		VI	I	LI	NI
1.	Pretest	18.10	50.48	22.86	8.57
2.	Posttest	41.90	52.38	5.71	0.00

Explanation:

VI = Very Interesting

LI = Less Interesting

I = Interesting

NI = Not Interesting

Based on the Table 5, there was an increase in the positive response in scientific attitude questionnaire. The increase occurred significantly in the assessment (Very Interesting) and (Interesting) with the posttest result of 41.90% and 52.38% respectively. The attitude that someone shows towards science plays an important role in terms of their interests, attention, and responses to science, the environment and issues that affect specifically. One of the goals of education was to develop an attitude that directs students to be more involved with scientific phenomena and

issues [12]. Attitude was a part of building scientific literacy. Then, it can be concluded that one's scientific literacy also includes scientific attitudes, self-efficacy, motivation, and certain values.

The final discussion was about student responses. Response was a self-readiness in determining attitudes in both positive and negative forms of an object or situation. The result of student responses regarding the developed teaching material can be seen in Table 6.

TABLE 6. RESPONSES RESULT

No.	Component Number Assessed Rating	Result (%)	
		Interesting	Not Interesting
1.	Contents of lesson	100.00	0.00
2.	Student Activity Sheet	93.33	6.67
3.	Textbook	86.67	13.33
4.	How the teacher teaches	100.00	0.00
5.	Learning atmosphere that is trained by teacher	80.00	20.00
6.	The steps directed by teacher in the learning process	93.33	6.67

Based on the result of the trends obtained, it could be concluded that the learning get respond positively by students. This was in line with the learning activities and implementation that were getting better at each meeting. The interested learning would give a positive response, because it attracts students to learn. This was the same as the research conducted by Suastra that learning based on ethnoscience was able to provided opportunities for students to express their thoughts and beliefs rooted in original science culture, encourage students to actively asking questions, respond, solve the problems, and motivate in order to be aware of the positive influence of local wisdom [13].

IV. CONCLUSIONS

Based on the result of the research that has been elaborated, the teaching material – based on ethnoscience Batik are appropriate to be used to increase the scientific literacy skill of junior high school students, and can be used widely.

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