The Validity of Teaching Material Based on Ethnoscience Batik to Increase the Ability of Scientific Literacy for Junior High School

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Abstract. Reflected from the results of pre-research about the ability of students on scientific literacy in Tulungagung, which was relatively low, the researcher has recommendation to develop a teaching material that can increase the skill of scientific literacy. In order to make it more interesting, it will be based on ethnoscience or local wisdom of Batik. The purpose of this study is to produce a valid teaching material, which will use contextual approach based on ethnoscience-Batik to increase the ability or skill of scientific literacy of learners in Junior High School. The specifications include the Learning Implementation Plan, Textbook, Student Activity Sheet (SAS), and the Scientific Literacy Test Assessment Instrument. The four major dimensions of scientific literacy that will be included in the literacy test are the aspects of scientific knowledge, scientific contexts, competencies or the process of science and attitudes. Model of the teaching material development in this research uses 4D model from Thiagarajan. Based on the assessment of three validators, the developed learning tools have considerably very valid category and can be tested for limited students in Tulungagung.

1. Introduction
The learning of the 21st century is marked by the paradigm shift from teaching to learning [1]. Learning teaches the students to learn independently to explore their own potential. At the beginning of learning, educators can arouse students’ curiosity about a phenomena or issue and then formulate it in the form of a question [2]. These issues and phenomena are related to the subject matter that is learned then the students seek solution to solve the problems. The process of problem solving is tough. One guidance for the ability of solving problems from an issue or phenomenon is by using the skill of scientific literacy [3].

The expectation of Curriculum 2013 (K13) is the increasing of scientific literacy on students in Indonesia. Based on the research results of PISA 2015, Indonesia is still in the 62nd out of 70 countries. From this result, it can be said that the scientific literacy of learners is still below average. The skill of scientific literacy is very important for every human being. When a person is in school, the skill of scientific literacy correlates to learning achievement. The time when they involve in the society, literacy skill correlates with socializing and solving life problems [3].

According to DeBoer [4], the efforts to increase the skill of scientific literacy is perpetually applicable for science because it is not static. Related to the research about scientific literacy that has
been done in various countries, it can be drawn a red thread that the common barrier that is faced by every school is the process of habituation, starting from learning environment that lack of literacy attitude, and systematic attitude problems faced by the learners which are different from PISA or TIMMS system. One of the methods to increase scientific literacy in Indonesia is by adding indigenous science or ethnoscience to teaching materials. The function of this ethnoscience is to make the process of learning is more interesting and attract the learners’ interest since it involves the identity of their own region. Ethnoscience that rooted in the life of learners is a form of direct or contextual experience [5]. The reason for integrating ethnoscience into the learning process is to provide a new understanding that local culture can be linked to science learning, fostering a sense of love for local culture, and preserving it.

Learning that is based on ethnoscience will ease students or learners to explore the facts and phenomena that exist in society and they can be integrated with scientific knowledge [6]. Currently, research of learning based on ethnoscience to improve any skills are developed continually. The concept of teaching material that can be associated with ethnoscience is the “classification material and its changes” in VII-grade of Junior High School. The material can be associated with ethnoscience Batik because the equipment for making Batik is related to the “classification of the material”. However, in general, increasing scientific literacy by using ethoscience learning is still rare. Therefore, researcher will be developing a teaching material-based on ethnoscience Batik in Tulungagung area by using material “classification materials and its changes”.

2. Method
The model that is used in this study is 4D model from Thiagarajan, et al [7]. The 4D development model consists of 4 phases: (1) define, (2) design, (3) develop, and (4) disseminate. In the define phase, the things that must be done is analyzing the front-end (front-end analysis), which consists of curriculum that is used, relevant learning theories, and challenges in the future. Furthermore, doing analyzing for students that covers academic ability and level of maturity. The third phase in define are material analysis, assignment analysis, and learning objectives formulation. Moreover, in the design phase, the activities that must be done consist of making literacy test, media selection for learning process, and then followed by the preparation of teaching material based on ethnoscience Batik, which consist of the Learning Implementation Plan, Textbook, Student Activity Sheet (SAS), and the Scientific Literacy Test Assessment Instrument.

Result from the preparation of teaching material is called “the initial design” or draft I. Furthermore, draft I will be reviewed by the lecturers or mentors to be given suggestions and improvements. In the develop phase, teaching material that is being developed will go through a revision process into draft II, which later on be validated by IPA lecturer, expert lecturer, and science teacher. The purpose of validation is to obtain the feasibility for the contents of developing teaching material so that it can be used for limited trials and extensive trials. The data of validation result was analyzed quantitatively. The average result of the components that is assessed by all validators will be analyzed qualitatively on each aspect by referring to the following criteria.

| Score interval | Category | Explanation |
|----------------|----------|-------------|
| $3.60 \leq V \leq 4.0$ | Very valid | Can be used without revision |
| $2.60 \leq V \leq 3.59$ | Valid | Can be used with a few revision |
| $1.60 \leq V \leq 2.59$ | Less valid | Can be used with many revisions |
| $1.00 \leq V \leq 1.59$ | Invalid | Not yet in use and requires consultation |
From the Table 1., it can be seen that the teaching material is said to be valid if it gets a score at the interval of $2.60 \leq V \leq 3.59$ and particularly to be very valid if it gets a score at the interval of $3.60 \leq V \leq 4.0$. However, if a developing teaching material belongs to invalid category then it should be revised, and has to be validated again.

3. Result and discussion

3.1 Result

The developing teaching material consists of (1) Learning Implementation Plan, (2) Textbook, (3) Student Activity Sheet (SAS), and (4) Scientific Literacy Test Assessment Instrument. Figure 1, Figure 2, Figure 3, and Figure 4 below are an example of an overview of developed teaching material.

The Learning Implementation Plan refers to the Syllabus as a supporting component of teaching material. The Learning Implementation Plan consists of three meetings that are based on ethnoscience Batik. The provision of writing KD refers to Permendikbud 24 Tahun 2016. Components in Learning Implementation Plan include school identity, subject, class/semester, subject matter, time allocation, KI, KD, Indicator of Competency Achievement, Lessons’ Purpose, material summary points, learning
method, media and materials, learning resources, learning steps, assessment and appraisal appendices [8].

The title of Textbook is "Material Classification and its Changes" which is supplemented by mapping concept, Basic Competence (KD), learning indicator, summary of the material that is connected with the material of making “Batik” and also changing that happened during the process of making Batik, ethnosciences information about Batik culture, examples of scientific literacy test, and bibliography [9]. Furthermore, There are three developed SAS for 3 meetings. The first meeting discusses the classification of the material based on its composition, the second meeting discusses the changes in the form of substances, and the last one discusses the activities of the mixture separation.

The SAS contains components such as title, KD, activity objectives, activity steps which is accordance with cooperative learning syntax, and bibliography [9]. Every SAS begins with a motivation that is generating a phenomena related to the material being studied. The presentation of material summaries in SAS is associated with ethnoscience Batik. Each SAS is completed with the organizing students into study groups, the guidance of the study group, guidance of the formulating problem, the materials that used for the activity, the steps of the activity, the observation table, the column data analysis, the discussion question and column for conclusion. The three SAS-based on ethnoscience Batik are complemented by key answers that make it easier for teachers to manage the learning.

The scientific literacy assessment uses 15 multiple choice questions and 7 scientific attitude questionnaires. The scientific literacy test refers to three indicators of PISA, that are explain (1) phenomena scientifically; (2) evaluate and design scientific enquiry; and (3) interpret data and evidence scientifically [10]. The three scientific literacy indicators are aligned with specific indicators on each item. Before having validation, the teaching material were reviewed by lecturers to get improvement and suggestions. It were validated by three validators (IPA lecturer, expert lecturer and science teacher). Validation result from the three validators can be seen in the following details.

| Table 2. Result of validation Learning Implementation Plan |
|----------------------------------------------------------|
| Aspect | Tendency Score | Category |
| The form | 4 | Very valid |
| Learning activities | 3,5 | Valid |
| Supporting learning activities | 4 | Very valid |
| Language | 4 | Very valid |

Based on the validation result in Table 2., it can be seen that the Learning Implementation Plan has a tendency score of 4 with very valid category. On the word, the developed of Learning Implementation Plan can be used as a classroom instructional guideline with a few revisions.

| Table 3. Result of Textbook |
|-----------------------------|
| Aspect | Tendency Score | Category |
| Foreword | 3,5 | Valid |
| Content | 3,6 | Very valid |
| Characteristics | 3,7 | Very valid |
| Ending | 3,67 | Very valid |
| Concept explanation | 4 | Very valid |
Based on the result of Textbook validation in Table 3., the average of tendency scores that are obtained from the validators is 3.7 with very valid category. It means that the developed of Textbook can be used as a media-based on ethnoscience Batik to increase the skill of scientific literacy at VII-grade.

Table 4. Result of Student Activity Sheet (SAS)

| Aspect          | Tendency Score | Category |
|-----------------|----------------|----------|
| The form        | 4              | Very valid |
| Feasibility of content | 3.5          | Valid    |
| Language        | 3.33           | Valid    |

Table 4. describes the result of the validators assessment on the Student Working Sheet (SAS) development. The results that are obtained from these aspects have an average of 3.6 with very valid criteria. These are three SAS for 3 times meetings.

Table 5. Scientific Literacy Test Assessment Instrument

| Aspect     | Tendency Score | Category |
|------------|----------------|----------|
| Content    | 3.6            | Very valid |
| Construction | 3.6           | Very valid |
| Language   | 3.78           | Very valid |

Table 5. presents validation result of scientific literacy test assessment instrument. From three aspects that are assessed, the average score obtained is 3.6 with very valid criteria. This scientific literacy test are used to assess the improvement of scientific literacy skill (after and before the learning takes place).

3.2 Discussion

The validity of teaching material uses a contextual approach (CTL) based on ethnoscience Batik in Tulugagung area. It aims to increase scientific literacy skill, has got a very valid result and can be used for limited trial. The learning uses STAD type of cooperative learning. According to Amedu [11], the cooperative model has a good effectiveness for students because the formation of learning group will be helpful for learners in understanding the materials and raising a positive communication.

The contextual approach contains 7 pillars of CTL, which are constructivism, inquiry, questioning, learning community, modeling, reflection and authentic assessment [12]. The CTL approach teaches students to use previous experiences and build a new experiences based on existing knowledge, and connect the content that have been learned with life content in which it can be used [13]. Students are expected to find the meaning in the whole of learning process. The meaning that can be taken is the link of “classification material and its changes” with local culture or ethnoscience. The ethnoscience is a knowledge possessed by a society or tribe of nations, which is derived by a particular method and follows certain procedures, which is a part of the tradition of society and its truth can be tested empirically [14]. The scientific learning that is able to be a bridge for learners culture and scientific culture in school will increase the effectiveness of learning process.

In addition to Learning Implementation Plan, teaching material are also equipped with the Textbook. This Textbook is a set of media that is used to help the students in learning activities or autonomous activities. Textbook that can be easily used by students and teachers. The good one of Textbook also should be accordance with the times and must be easy to understand, or does not lead to multiple interpretations [15]. The developing of Textbook is expected to strengthen the scientific
concept. It is strengthened by Chung and Keckler’s research [16], which says that teachers can encourage the students to explore concepts, vocabulary, and scientific literacy skill from an early age with a book or the quality literature.

In addition to Learning Implementation Plan and Textbook, there are 3 items of Student Activity Sheet (SAS) that can make the students more active during the learning process. It is by working together with their groups, helping students in developing concepts, training in finding, and developing the skills of scientific process, and helping students to obtain the recording of material that have learned through the activities of observations or experiments [17]. The SAS can also be used to train the skill of scientific literacy by referring to scientific activities such as formulating problems, making research hypotheses, analyzing activity or observing data and drawing conclusions. That is in line with Genc’s research [18], which says that scientific activity has effective function to improve the skills of scientific literacy and scientific attitudes.

The last one is the Instrument of Scientific Literacy Test Assessment. The instrument contains 15 items of multiple choice and 7 scientific attitude questionnaires. This test is adapted to the theme that is being studied, which is ethnoscience Batik. This assessment instrument comes with a rubric or grid of answer to facilitate the teacher in the assessment process. The literacy questions refer to the PISA 2015 form. The literacy indicators of science that is used largely consist of identifying scientific facts/phenomena; analyzing scientific evidence/scientific phenomena related to environmental and scientific research; and using scientific evidence/research to formulate problems, hypothesize and conclude from scientific research. The indicators are aligned with the specific indicators on each test item.

4. Conclusion
Based on the explanation above, the validation result by the three validators indicates that the teaching material has a very valid category. The teaching material that based on ethnoscience Batik by employing a contextual approach can be tested to try on class VII grade in SMP N 1 Bandung Tulungagung. The function of this research is to increase scientific literacy skill of students on material of “classification materials and its changes”.

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