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VALIDITY OF ETHNOSCIENCE-BASED TEXTBOOK ON ENVIRONMENTAL CHANGE TOPIC TO INFLUENCE ENVIRONMENTAL LITERACY SKILL OF 10th GRADE HIGH SCHOOL STUDENTS

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Abstract

Environmental Change topic can be taught by integrating ethnoscience in learning proccess, because it can produce more meaningful learning, such as to influence students' environmentally literacy skills. One way to integrate ethnoscience in learning is through textbooks. The purpose of this research was to describe the validity of ethnoscience-based textbook on environmental change topic to influence environmental literacy skill of 10th grade high school students. The development of this ethnoscience-based textbook was held in Biology Department, Faculty of Mathematics and Natural Sciences, Universitas Negeri Surabaya. This research used 4-D developmental model (Define, Design, Develop, and Disseminate), however this research was done until develop stage. Data collected by validation method and validity sheet as it instrument. The data then analyzed by descriptive technique. Result showed that ethnoscience-based textbook had special characteristics that were presented in the features of the study of ethnoscience, environmental literacy features, and other supporting features. Based on the validity result, which included the feasibility of presentation, graphics, content, and language by experts, these ethnoscience-based textbook gained a score with mode of 4 and a very feasible category mode. Thus, ethnoscience-based textbook was very feasible and can be applied in biology learning.

Keyword : validity, ethnoscience, textbook, environmental topic

INTRODUCTION

A change in the 21st century requires government to adapt the national education system through new policies, such as an implementation of 2013 Curriculum. The 2013 Curriculum is more based on character and competence. Through the 2013 Curriculum, students are expected to develop their potential into learning outcomes which are in accordance with Graduate Competence Standard (SKL) (Kemendikbud, 2012). Level of ability that must be possessed by students to achieve the SKL was embodied on Core Competencies (KI) (Kemendikbud RI, 2016a).

Some of KI that have been determined in the 2013 Curriculum, are translated into several Basic Competencies (KD) that must be achieved in learning, including KD 3.11 Analyze data on environmental change topic, it causes, and it impacts on life and KD 4.11 Formulate several ideas to solve environmental change issues that was occured in surrounding. Those KD were discussed the scope of the Environmental Change topic and demanded the competence of students to analyze data/information, make a conclusion, and provide solutions to solve the environmental change issues (Kemendikbud, 2016b). Moreover, the environmental change issues were became a major issue that must be solved on the 21st century (BSNP, 2011). Therefore, an appropriate learning method is needed to study the Environmental Change topic in KD 3.11 and 4.11.

Reality then showed that learning proccess on Environmental Change topic was conveyed by methods or some of learning approach which are not corresponding with KD demands, minimal in the use of learning models and sources, and monotonous (Hayati, et al., 2016; Prasetiyo, 2017; Azizah et al., 2017). As a result, students's understanding on Environmental Change concept, their ability to solve environmental issues, and their environmentally responsible behavior had not been achieved optimally (Choirunnisa & Irsadi, 2014).

The right way to learn Environmental Change topic is to consider the cultural background differences of students and based on various learning resources, like textbooks (Kemendikbud, 2016c). The findings of the analysis of local cultural substance by Ramli (2012) on

several high school biology textbooks has indicate that the integration of local culture is much discussed on biodiversity and ecosystem topics. Whereas Ardan, et al. (2015), stated the material content in biology textbooks had not yet discussed the local culture. Usually, learning proccess that use textbook which is discussing the examples of local culture can be taught through an ethnoscience approach (Ristanti & Rachmadiarti, 2018).

Ethnoscience is a set of knowledge that reconstructs the original and distinctive science of a society by using certain scientific methods so that the truth can be empirically tested. Ethnoscience examines four field studies related to local culture, local species, local technology, and the usefulness of society's local knowledge. In addition, it also discusses about how the society's local knowledge were used to understand the environment and it situation at that time, norms and values that became a foundation of the society to act and adapt to environmental conditions (Sudarmin, 2014). Snively & Corsiglia (2000), then stated that traditional knowledge can be integrated to solve environmental problems, so it can be able to form environmentally illiterate person.

Environmental literacy according to the North American Association for Environmental Education (NAAEE) (2011), is defined as the environmental conscious ability of a person to be able to make decisions based on information about the environment, willing to act to improve environmentally global welfare, and participate in society life. There are four components to measure person's literacy status, such as knowledge, cognitive skills, environmentally attitude, and environmentally responsible behavior (NAAEE, 2011).

Previous research conducted by Rahayu & Sudarmin (2015), stated that the development of ethnoscience-based module for junior high school student was feasible. In addition, the module was also effective to instill the students' conservation spirit. Another research conducted by Mukhyati & Sriyati (2015), also stated that the development of teaching materials on environmental change topic based on local reality and environmental literacy for high school students was produced a teaching material that was feasible to be tested and suitable to built students' environmentally awareness.

Based on the background description, the research of the ethoscience-based textbook has done. The feasibility of the ethnoscience-based textbook were assessed based on the validity results, so the purpose of this study was to describe the validity of ethnoscience-based textbook on Environmental Change topic to influence the environmental literacy skill of 10th grade high school students.

METHOD

This research fits in with the developmental research type. This research was used 4-D developmental model (Thiagarajan et al., 1974), then it adapted only 3-D model with Define, Design, and Develop stage.

1. Define

The defining stage was done to establish and define the learning conditions and preparation of textbook. This stage includes five main steps, that are initial analysis, student analysis, task analysis, Environemntal Change concept analysis, and learning objectives formulation of KD 3.11 and 4.11.

2. Design

The designing stage aims to compile the initial pre-draft of textbook. Basic format of the ethnoscience-based textbook are:

a. Introduction, consist of front cover, cover page, preface, table of contents, explanation of book features, KD and indicators for KD 3.11 & 4.11, user guide manual, and concept maps of Environmental Change topic.
b. Content, consist of:
   1) opening section, consist of learning objectives, a brief description of Sub-Chapter, a representative image, and introduction of the Sub-Chapter;
   2) content section, consist of material description and book features. In this section, some important features are provided as a identity of the textbook, including:
      a) study of ethnosains features, which are found in *Zona Etnosains* and *Yuk, Lebih Mengenal Etnosains*;
      b) environmental literacy features, consisting of *Mari Berliterasi* and *Mari Beraksi*;
      c) other supporting features, consisting of *Fakta Bio*, *Laman Bio*, *Pojok Seni*, and *Rangkuman*.
   3) closing section, consist of a summary and evaluation in the *Ayo Refleksi Diri*.
c. Closing, consist of final evaluation questions, bibliography, glossary, index, and back cover.

3. Develop

The development and study of the ethnoscience-based textbook had done in the Biology Department, Faculty of Mathematics and Natural Science, Universitas Negeri Surabaya on October 2018-June 2019. The feasibility test of ethnoscience-based textbook assessed by validation methods and validation sheets as it instrument. The validity of texbook was reviewed based on the results of the evaluation of several validity items on the qualification of presentation, graphics, content, and language. The validation sheet instrument was adapted from BSNP (2014). Validators divided into theoretical

validators (material expert and educational expert) and empirical validator (high school biology teacher).

Data then analyzed by descriptive statistics technique. Scores from the validity test then calculated according to the score criteria contained in the validation sheet. Furthermore, the mode values of each qualification on validation sheet value from all validators and overall mode are recapitulated, then it interpreted according to **Table 1**.

Tabel 1. Interpretation of Textbook Validity Assessment

Score	Category
4	Very Feasible
3	Feasible
2	Quite Feasible
1	Less Feasible

(Riduwan, 2012)

The ethnoscience-based textbook will be categorized as a feasible textbook if it gets an assessment score of ≥3 for each validation item.

RESULTS AND DISCUSSION

This research was produced an ethnoscience-based textbook on Environmental Change topic to influence environmental literacy skill of 10th grade high school students (**Figure 1**). The ethnoscience-based textbook has some special characteristics, like presented on book's features, such as presenting activities that can influence four components of environmental literacy skill, such as knowledge, environmentally attitude, cognitive skill, and environmentally responsible behavior wich presented on environmental literacy feature. Beside that, it also was presenting activities to understand and overcome environmental problems through examples of local cultural studies around the place where the students live and other societal cultures that are still interrelated which presented on ethnoscience feature.

The ethnoscience-based textbook also has other characteristics, such as has a colorful display, and has parts that are compatible with the criteria of other good textbook, such as introduction, content, and closing section (Kemendikbud, 2016d). This book also contains five Sub-Chapters, such as Environmental Change and their Causes, Environmental Damage and Pollution, Environmental Issues, Efforts to Overcome Environmental Change, and Environmental Ethics.

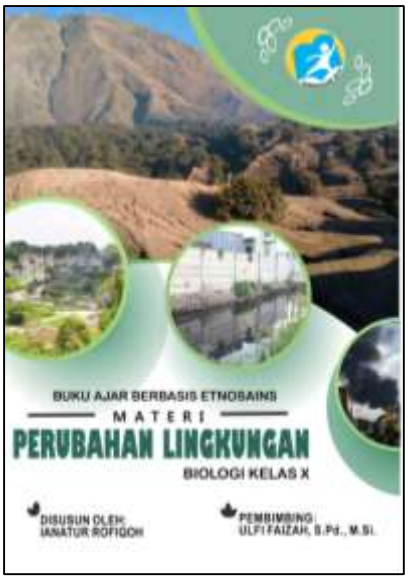

Figure 1. Front cover display of ethnoscience-based textbook

The ethnoscience-based textbook subsequently has several advantages, which are equipped in important features as book identities as in (**Table 2**). It consist of etnoscience features, environmental literacy features, and other supporting features. Those features are expected to provide learning motivation to students. According to Manuhutu (2015), motivation needed by someone to support the implementation of learning activities.

Table 2 Several Features of The Ethnoscience-based Textbook on Environmental Change Topic

Features	Features Explanation
Ethnoscience Features	
	***Zona Etnosains***, contains an information about studies of how the science and culture in the society can be integrated and used to protect the environment
	***Yuk, lebih mengenal etnosains***, is an advanced feature of the *Zona Etnosains*, which contains questions related to information on the *Zona Etnosains* feature
Environmental Literacy Features	
	***Mari Berliterasi*** engage students to investigate, analyze, and evaluate an information by discussing it in groups
	***Mari Beraksi*** engage students to make useful ideas/solutions to solve problems based on the information that has been given

Features	Features Explanation
	***Ayo Refleksi Diri***, contains questions to check students' understanding while studying the material and to check their environmental literacy skill
Other Supporting Features	
	***Fakta Bio***, contain a brief fact related to environmental change topic
	***Laman Bio***, contain a web page and QR code that can be scanned ad visited by students to add information related to environmental issues, it impacts, and solutions
	***Pojok Seni***, contain some of arts as a result of criticism and humor related to the environmental change issues
	***Rangkuman***, contain a summary of the material for each Sub-Chapter

During the design and develop stage, several changes and improvements were made to make the ethnoscience-based textbook better and more feasible according to the advice from the experts (**Table 3**). In general, the changes and improvements that were made can be listed as following: made a change of the front cover image, adjust the description of the image on the front cover, improve color and features background, change the contents of *Zona Etnosains*, *Mari Berliterasi*, and *Mari Beraksi* feture, and adjust the content in each Sub-Chapter, so it can show the metacognitive competencies.

Table 3 Several Changes And Improvements on the Ethnoscience-based Textbook

Changes and Improvements	Before	After
Made a change of the image on the front cover with a picture from personal documentation and adjust the image description on the front cover		
Made a change of the background color and feature to make it more attractive, colorful & clear		
Add an explanation/made a chenge on the *Zona Etnosains* feature to covers the four field of ethnoscience (local culture, local species, local technology, and the usefulness of local knowledge)	Sub-Chapter 1 on study of "Indigenous Peoples and Environmental Change" • The field of study had not yet presented a discussion on local technology	• Already discussed the entire fields of study of ethnoscience • The local technology that discussed is related to the traditional irrigation techniques which are mostly used by indigenous people as a form of adaption to environmental change/climate change
	Sub-Chapter 4 on study of "Efforts to Overcome Environmental Change " • The field of study had not yet presented a discussion of local species and local technology • The study entitled: "Customary Law of the Petapahan Society in Environmental Management as an Effort to Fulfill the Rights of Indigenous Peoples"	• Already discussed the entire fields of study of ethnoscience • The study was changed to: "Clean Water Source Conservation Model in Communities Around Telaga Rambit, Sidayu Gresik" • Field study of local species that discussed is related to local plants planted around the lake • The field study of local technology that discussed related to the traditional technique for taking lake water using a bucket

Changes and Improvements	Before	After
Made a change of *Mari Berliterasi* feature in Sub-Chapter 3 which is not focused on specific society/area	• A case is still general and occur in several regions • The study entitled: "We, Coal, and Air Pollution: A Case Study of Tanjung Jati B PLTU in Jepara and Batang Central Java PLTU"	• The case is more specific in one area/society • The study was changed to: "Poor Air and Nutritional Conditions, 727 Gresik Babies were Sentenced to Have Pneumonia"
Made a change/ add some explanations on the introduction of Sub-Chapter and before the *Rangkuman* feature to show the existence of metacognitive competencies	There are no explanation/text to check before and after students' understanding regarding to the material in the Sub-Chapter that will be and was studied	Add some explanations to check before and after students' understanding regarding to the material in the Sub-Chapter that will be and was studied, like: • "Before studying the following material, try to explain what you already know about environmental change and it causes? • "In this chapter, you have learned about what is environmental change, how is the conditions of a healthy environment, environmental change facors, also indigenous peoples and their relationship to the environmental changes. Therefore, try to remember and explain what is the environmental change and it causes according to your understanding"

After revised the ethnoscience-based textbook, then it assessed for feasibility. Validity of ethnoscience-based textbook based on four main qualifications, which are the qualification of presentation, graphics, content, and language (BSNP, 2014). Results of the feasibility of the ethnoscience-based textbook concluded from the results of the validity by three validators. The data recapitulation of the validity of ethnoscience-based textbook is presented on **Table 4**.

Table 4 Data Recapitulation of the Validaty Results of Ethnoscience-based Textbook

No	Criteria	Mode	Category
1	Presentation qualification	4	Very feasible
2	Graphics qualification	4	Very feasible
3	Content qualification	4	Very feasible
4	Language qualification	4	Very feasible
	Category Mode	**4**	**Very feasible**

It was known that the ethnoscience-based textbook gained a score mode of 4 and the mode category of "very feasible" (**Table 4**). Category mode of very feasible obtained in each qualification which includes the qualification of feasibility in presentation, graphics, content, and language.

The ethnoscience-based textbook had the eligibility criteria for presentation qualification by obtaining a very feasible category (**Table 4**) and it in accordance with the eligibility criteria for presentation according to BSNP (2014). The presentation technique of ethnoscience-based textbook has been coherent and consistent; supporting material presentation items was included image illustrations, numbering, images and tables title. It also was able to influence students' environmentally literacy skills, and stimulate the active participation of students in learning. All of those activities can be done because the ethnoscience-based textbook had been oriented based on students' culture and their environment, so that they are able to solve problems in their environment (Okwara & Opu, 2017). The presentation completeness of the ethnoscience-based textbook are consisting of introduction, content, and closing sections, which are in accordance with the Kemendikbud (2016d), and had presented several of book features (**Table 2**).

On the graphics feasibility qualification, which consist of two assessment criteria, results showed that the validity of the ethnoscience-based textbook on this component got a very feasible category mode (**Table 4**). It because of the ethnoscience-based textbook has several common physical appearance, such as B5-sized according to ISO standards, the size of the letters was adjusted to the

level of education of high school students (Main & Widyani, 2014), and has a cover design which is in accordance with BSNP standard (2014), suchs as has a more dominant book title , the color of the title of the book contrasts with the background of the cover, the illustration of the image and arrangement of the elements of the layout on the cover is clear and appropriate (**Figure 1**).

The ethnoscience-based textbook also fulfilled the six criteria for assessing the eligibility of content. The criteria for assessing content qualification include the compatibility of textbook material with KD 3.11 and the scope of material in accordance with the material on Environmental Change topic in the Content Standards on Permendikbud No. 21 of 2016, which includes five Sub-Chapters (Environmental Changes and their Causes, Environmental Damage and Pollution, Environmental Issues, Efforts to Overcome Environmental Change Problems, and Environmental Ethics).

The other criteria of content qualification were the accuracy of the material that is in accordance with the facts and does not generate multiple interpretations, material and contextual updates that are in accordance with the conditions in the 21st century, according to law, and can develop some competencies on KD 4.11 (BSNP, 2014). KD 4.11 stated the competency to formulate ideas to solve environmental problems, which was facilitated through *Mari Beraksi* feature. One example of the *Mari Beraksi* feature is in Sub-Chapter 4, which discusses some of environmental issues like waste pollution which can be overcame by various innovations based on students' opinions, such as recycling plastic waste into various handicrafts and composting organic waste.

The ethnoscience study which displayed on the textbook also compatible with the material of Environmental Change topic. Ethnoscience study is the result of the transformation of local science into scientific science, for example on Sub-Chapter 1, which showed the study related to indigenous peoples and how they faced several changes in the environment with their various local knowledge and cultures. The ethnoscience study also included four fields of study of ethnoscience according to Sudarmin (2014), which included studies of local culture, local species, local technology, and the usefulness of local knowledge of the community. The ethnosciences study was shown in the features of *Zona Etnosains* and *Yuk, Lebih Mengenal Etnosains.*

The ethnoscience-based textbook also had been in accordance with the characteristics of other ethnoscience-based textbooks, such as combined the scientific concepts with the culture of society through concise drawings and a brief explanation (Ristanti & Rachmadiarti, 2018), discussed specific themes (public trust in myths to preserve the National Park of Baluran on Sub-Chapter 2, local wisdom of the people around Telaga Rambit Gresik to maintain clean water resources on Sub-Chapter 4, and forms of environmental ethics in the Kampung Naga community on Sub-Chapter 5) and the general theme of ethnoscience (discussed about indigenous people on Sub-Chapters 1 and 3) (Fitria & Wisudawati (2018), covers the cognitive, attitude, and skill competency fields (Fitria & Wisudawati (2018), and can guide students to gain meaningful learning experiences, such as to influence students' environmentally literacy skills (Listyawati, 2012; Rahayu & Sudarmin, 2015).

The ethnoscience-bsed textbook also adapted to environmental literacy skills, because one of the characteristics of people who have environmental literacy skills is able to explore how culture in their society contribute to their environment (Loubser et al., 2001). In the criteria of compatibility with environmental literacy, the ethnoscience-based textbook had fulfilled all indicators of the component of environmental literacy according to NAAEE (2011) and Simmons (1995) in Karimzadegan & Meiboudi (2012), which includes knowledge, environmentally attitude, cognitive skills, and environmentally responsible behavior.

The entire components of environmental literacy were contained on the material on each Sub-Chapter and the book's features. One example is in the *Mari Berliterasi* feature and *Mari Beraksi* featue to support one of the environmental literacy components in the form of cognitive skills. Both of these features contain activities that can engage students to identify, analyze, and evaluate environmental issues and then formulate ideas to solve environmental problems, for example in Sub-Chapter 2 which provides a study about problem of plastic waste pollution in the oceans, which facilitated through *Mari Berliterasi* feature and information about alternative solutions overcoming the problem of waste in the ocean through the Wayang Samudra's show which facilitated through *Mari Beraksi* feature.

On the language feasibility qualification which consists of three assessment criteria, such as readability and it ability to motivate students, it simplicity and selection of spelling, words, and sentences which are in accordance with language rules, and the use of consistent terms/symbols (BSNP, 2014). The result of the validity of ethnoscience-based language qualification got a very feasible category mode (**Table 4**). However, on the criteria for readability and motivational ability, there is one validator who gives a score of 3. Regarding this problem, revisions are made according to the suggestions of the validator, suchs as add the meaning to difficult words so that they become more general and interactive, like add the meaning of religio-magical word with "everything that is always related to religious and mystical issues".

CONCLUSION

Based on the results and discussion, it can be concluded that the Ethnoscience-based Textbook on Environmental Change Topic to Influence Environmental Literacy Skill of 10th X High School Students is very feasible based on the validity results of presentation, graphics, content, and language qualifications by the experts with the score mode of 4.

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