

Ethno-Science Based Module Development on Material Substance and its Characteristics to Improve Learning Achievement of Junior High School Students

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Date of publication (dd/mm/yyyy): 04/06/2019

Abstract – The research aims to develop ethno-science based module for material and its characteristics in order to know the feasibility, learning achievement, and student responses to the module. Population for this research was student of class VII SMPN 8 and SMPN 14 Banda Aceh. Samples were purposively choose and divided into two types which are 58 students for class of experiment and 59 students for class of control. This research is one of development research by using model of ADDIE. Ethno-science based module was implemented using quasi experimental method with pretest and posttest control group design. Data were collected using validation test, written test and questionnaire. The data were analyzed using several methods such as percentages, N-gain and t-test. The results showed that the developing module was feasible to be used with the score percentage of 92.15% and 92.87% given by experts and science teachers, respectively. In addition, N-gain accompanied by t-test obtained $t_{count} > t_{table}$ ($3.987 > 1.984$) which represented that there is any difference of student learning outcomes between class of control and class of experiment, where the class of experiment showed the higher results than class of control. Besides that, the students also gave positive responses to the module. Therefore, it can be concluded that ethno-science based module is feasible to be used and increased the student learning outcomes, indicated by positive responses of students.

Keywords – Module of Material and Its Characteristics, Ethno-Science, Learning Outcomes.

I. INTRODUCTION

Curriculum 2013 is designed to facilitate learning experience to students widely, where they can interact directly to the learning sources. Furthermore, science learning based on 2013 curriculum proposed to science teachers is given opportunity to develop and conduct the relevant learning correlated to local wisdom around student environment (Kemendikbud, 2013). Other than that, for a years, science was still taught with low perception with local communities (Lia et al., 2016), thus it lead students assumed that learning of science is very monotonous and not meaningful to their learning achievement (Nisa et al., 2015).

Low learning achievement of students in learning of science is can be seen in national examination data (UN) SMP for last three years which exhibited the score decline from academic year of 2015/2016 to 2017/2018 with percentages of 56.27; 52.18; and 47.45, respectively. According to data of 2017/2018, topic of material and its characteristics is one of results that represented low achievement with the percentage of 36.32 for students in SMPN 8 Banda Aceh, whereas data of SMPN 14 Banda Aceh showed the results with percentage of 40.42 (Puspendik, 2018).

Based on observation conducted in SMPN 8 Banda Aceh, it indicated that learning is only delivered by teachers or well known as teacher-centered learning. Besides that, student only used textbooks during learning of science

even the book does not provide correlation between learning topic and their environments, so it makes them not to understand the relationship between science concepts for living and local wisdom. It can be seen from this topic, the student only learn it scientifically, but it is still lack of correlation with their daily life experiences, thus it makes their achievement stay at low level. As example, the acidic materials were widely available in the world, one of them is *asamsunti*. *Asamsunti* is of natural flavor which is frequently used by many people in Aceh for cooking. This product is made of special star fruits (called as *belimbingwuluh*), so it helps students to remember about the examples of acidic compounds which is also found around them easily. But, the learning tools used for a years never provides the information and correlation between scientific concepts and general concept related with their life and local wisdom, thus it created non contextual learning. After that, observation to teachers also proved that the school did not provide learning tools integrated with environment and local wisdom, because it will influence the student learning achievement.

One of ways that can be done to improve student achievement is making correlation between learning topics and daily activities around their environment as learning source, so that it will be more benefit for them by using learning tools integrated with local wisdom (Khoerunnisa et al., 2016; Nisa et al., 2015). This finding is related with research presented by Suprapti et al., 2018, the meaningful learning improved student learning achievement, because they can comprehend the learning material well.

Learning tools that provided by school such as textbooks and others book collected by school library were still abstract to be used for learning (Martiningsih et al., 2018). Therefore, teachers must be eligible to design various learning tools for more flexible learning, so the students will not feel bored as before (Amila et al., 2018). According to Hindarto et al., (2017), students are tended to love simple learning materials, concrete and have relation to their life environment. Besides that, the use of learning tool which are relevant with student necessary enhanced their memory during learning (Yuh-Tyng et al., 2011; Anwar et al., 2017). As example, the learning tool is integrated with local wisdom around student environment or well known as ethno-science. Research done by Sudarmin et al., (2017) reported that ethno-science approach taught through module as learning tool increased student learning achievement.

Ethno-science is indigenous knowledge from a culture that is connected with scientific knowledge, or is called knowledge owned by a nation (Abonyi et al., 2014; Parmin et al., 2017). Ethno-science based module is developed by adapting the results of research provided by Rosyidah et al., (2013) who developed ethno-science based module in learning topic of food and its additives. So, it has the similar chance to develop the module for learning topic of material and its characteristics. Therefore, it is important to develop ethno-science based module in order to improve student learning achievement.

Several studies concerned on developing and using ethno-science based learning tools have been done and giving positive influences for learning, as stated by Sudarmin et al., (2017) and Rosyidah et al., (2013) explained that using ethno-science based module in learning material and its characteristics is capable to train students to be more active and increased their learning achievement. Other than that, the use of ethno-science based video also improved the student learning achievement during learning of science (Adhi et al., 2018). In addition, Okwara and Upu (2017) and Sultan et al., (2015) concluded that these learning is considered success to improve student achievement and their interest to knowledge and basic technology, and also gave positive effects to their cognitive learning.

According to problem presented above, it is important to do research concerned to develop ethno-science based module for learning topic of material and its characteristics in order to improve student learning achievement, thus they will comprehend the correlation between science concepts that have been learned and their environment and local wisdom.

II. METHOD

The method that used for this study was Research and Development method (R&D) with ADDIE model, and the research flow was shown in Figure 1. The research design was pretest and posttest control group. Population was student grade VII of SMPN 8 and SMPN 14 Banda Aceh. Samples were selected using random sampling technique to determine class of control and experiment. Then, it has 58 students for class of experiment from class VII-1 and VII-7, where as 59 students for class of control from class VII-5 and VII-1.

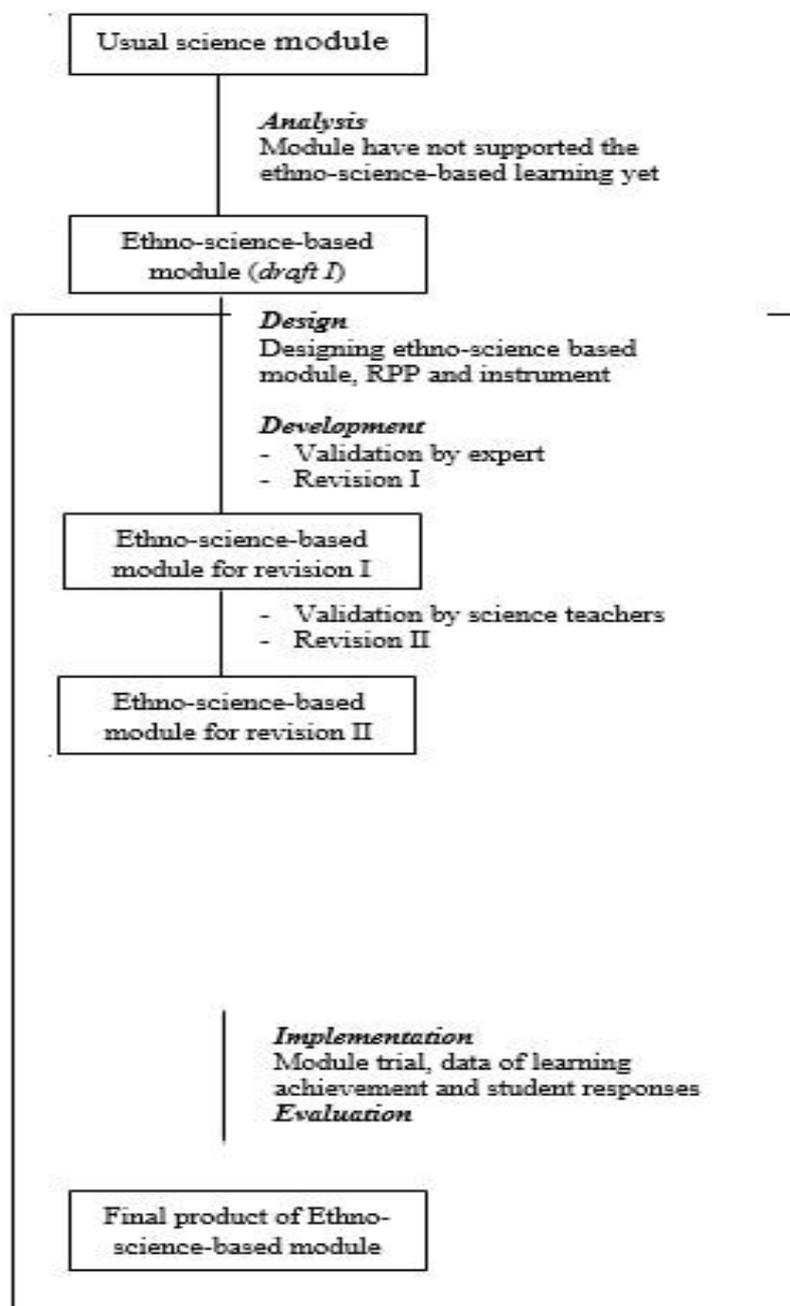


Fig. 1. Flow chart for research on ethno-science based module development.

Data were collected using validation sheets, questions test, and questionnaire. They were analyzed using percentages for validation test and questionnaire, and N-gain through t-test for learning achievement.

III. RESULTS AND DISCUSSION

This research has been carried out with data collected as needed. These data are then analyzed to determine the feasibility of module products developed, student learning outcomes from both classes are there differences, and students' responses to science modules are based on ethno-science.

A. Product Development for Ethno-Science-Based Module

The development of ethno-science-based module on material substance and its characteristic used the ADDIE model which consists of analysis, design, development, implementation and evaluation.

1. Analysis;

The process of analysis is done by interviewing teachers and students who are in school. Based on the results of observations conducted in SMPN 8 Banda Aceh, it was found that all this time students were still ignorant and unable to apply the links between science concepts that had been learned with life in their environment and culture. In addition, the results of interviews with teachers revealed that there was still a lack of teaching materials in the form of modules integrated with the environment and culture around life, as a result students lacked understanding of science concepts, thus making student learning outcomes low. Students are also known to only use the Ministry of Education and Culture (Kemendikbud) publisher's textbook contained in the library as teaching material. Therefore, as one of the solutions developed teaching materials in the form of science modules based on ethno-science. This is according to what Siagian et al., (2018) pointed out that teachers must be able to design and produce learning tools or teaching materials that are complete and systematic so that they can inspire students to learn actively.

2. Design

Modules that have been designed consist of several parts starting from module description, module usage instructions, KI, KD, objectives, concept maps, learning material, student worksheet (LKPD), practice questions, and bibliography designed based on the ethno-science approach. This module is designed using Microsoft word application, A4 paper size, maiandra GD and arial narrow letters with size 12. This module is also designed with bright colors and images related to the environment and culture that are around the student's life, with purpose to attract students' attention.

3. Development

The development stage begins with a validation process. The assessment of module feasibility is based in terms of content, method of presentation, language, completeness, ethno-science and media orientation. The first stage is an expert assessment and revisions are made according to expert advice. The results of the assessment by experts can be seen in Table 1. Furthermore, in the second stage, after being validated by experts and revised, the second stage of validation was carried out by 3 science teachers, and the teacher's assessment of the module is presented in Table 2.

Table 1. Results of assessment by experts.

No	Assessed Aspects	Module Feasibility Assessment (%)	Criteria
1	Content feasibility	91,67	Very feasible
2	Presentation feasibility	90,67	Very feasible
3	Language	93,15	Very feasible
4	Ethno-science Orientation	98,81	Very feasible
5	Media	93,18	Very feasible
	Average	92,15	Very feasible

Table 2. Result of feasibility assessment for module by science teachers.

No	Assessed Aspects	Module Feasibility Assessment (%)	Criteria
1	Content feasibility	91,67	Very feasible
2	Presentation feasibility	90,67	Very feasible
3	Language	94,05	Very feasible
4	Ethno-science Orientation	94,81	Very feasible
5	Media	93,18	Very feasible
	Average	92,87	Very feasible

Based on Tables 1 and 2, it was found that the module assessment by science experts and teachers showed that the module was very feasible, so it can be concluded from the two stages of validation for module on material substance and its characteristics based on ethno-science were feasible and could be used by teachers and students in the learning process. This is in line with the results of Lia et al., (2016) that the module product assessment process consists of five aspects, namely content (material), language and feasibility of presentation, ethno-science, and media aspects, which are carried out in two stages in stage I, overall values experts amounted to 82, 67 with a fairly valid category and in stage II with an average of 90% or very valid.

4. *Implimentation;*

At this stage the application process of the module is carried out which has passed the validation process. The application of this module is done in SMPN 8 and SMPN 14 Banda Aceh, with the aim to test the hypothesis whether there are differences in learning outcomes between classes that learn with ethnics-based modules (experiments) with classes that study without using the module (control), and knowing students' responses to learning by using module based on ethno-science.

The experimental class is class VII-1 and VII-7, while the control class is class VII-2 and VII-5. In this implementation process before learning begins students are given a pretest to know the initial level of ability, until later at the end of the learning process is given posttest to determine the level of ability of students to increase or not. The question of the pretest-posttest is in the form of multiple choices totaling 20 questions. After the learning process is complete in the experimental class students are given a questionnaire to find out how students respond to the ethno-science-based module which consists of 13 items of statements.

5. *Evaluation*

The evaluation is the final step, and at this stage the assessment was done in both class of control and experiment. Furthermore, the stage tried to indicate student responses to the implementation of ethno-science-based module.

B. Student Learning Achievement

The assessment for student learning outcomes on materials substance and its characteristics was obtained from score of pretest and posttest, and N-gain to understand the improvement of student learning outcome between class of experiment and class of control in SMP.

The results obtained that the initial ability (pretest) of students to the substance material and its characteristics have almost the same value, but the posttest value has increased, but the experimental class is better than the control class which is seen from the N-gain value of both classes namely class experiment 55,88 with moderate category, while control class 37,61 with low category. This result is supported by Carnawi et al., (2017) study that students who study with the ethno-science approach will experience a good increase, namely N-gain 0,51 moderate criteria versus control class 0,13 with low criteria.

Based on the results obtained, the learning outcomes data were analyzed to test learning related hypotheses using material material modules and their characteristics based on ethno-science in the experimental class compared to the control class without using the module. Testing this hypothesis is done through statistical tests using SPSS 20 software. The results of the hypothesis test analysis are carried out on the N-gain value data presented in Table 3.

Table 3. Analysis results of t-test for N-gain score.

Classes	N-gain Score	t-test		Result
		T _{count}	t _{table}	
Experiment	55,88			Any difference
Control	37,61	3,987	1,984	

The results of data analysis, testing the N-gain value tested for the average difference in Table 3, according to $t_{count} \geq t_{table}$, this indicates that between the experimental and control classes there are significant differences in meaning after the learning activities carried out in the experimental class and the level of student learning outcomes control, which means the N-gain value of the experimental class is higher than the control class. This shows that there is a good influence on learning using modules on material and its characteristics based on ethno-science, so students are more interested in learning, which results in increased learning outcomes. The difference in learning outcomes obtained occurs because of the atmosphere of enthusiasm and activeness of students in the learning process, so the value of the experimental class learning outcomes is higher than the control class.

The high learning outcomes obtained by students in the experimental class are also caused by learning activities that pay attention to the stages of ethno-science as contained in the module based on ethno-science, starting from step (1) orientation; contains an explanation of the subject matter, (2) exploration; identify cultural information related to indigenous knowledge, (3) reconstruction; reconstructing indigenous knowledge of society, and (4) application; draw conclusions and answer questions or work on the LKPD. At this stage students are invited to associate science learning at school with the knowledge contained in the environment and culture around them.

This finding is relevant with research done by Atmojo (2015), learning of science which is oriented to local wisdom will lead students to be interested with the learning topic and increased learning achievement and their appreciation to the local wisdom around them. Besides that, ethno-science approach will improve student ability to comprehend the core of science (Khoiri et al., 2018), and the integrated science learning will train students to connect social and culture aspects to be close with science (Chowdhury, 2016). Khusniati et al., (2017) also proved that through the observation and reconstruction of original science will improve student characters for conservation. In addition, they also learned on to optimize the creativity (Sitorus, 2017).

Gondwe and Longnecker (2014) explained that students obtained knowledge from their daily life and it depends on culture influenced from generation to generation from their family and society, so it can be said that cultural knowledge consist of words, activities and practices of their daily life.

The use of ethno-science based module for learning makes students to be more active and independent. This is related to the research conducted by Rahmawati et al., (2019), ethno-science has significant influence to the learning activity. Besides that, Sumarni et al., (2016) reported that using natural resources and cultural environment for learning ease student to find correlation between what they have been learned and their daily life. By this learning, they will get deep comprehension and make learning to be more contextual and meaningful (Dewi et al., 2017). Moreover, research conducted by Topaloglu and Kiyici (2015) concluded that it is important to use learning environment out of school, because it will contribute to teaching for more easy learning.

The ethno-science based module on materials substance and its characteristics that are used have a positive influence which makes the experimental class students have higher learning outcomes than the control class which means there are differences between both of them. This proves that the ethno-science approach embedded in the module until the development of ethnics-based modules on science material becomes a solution that can overcome the problems that have existed so far, which can improve student learning outcomes, especially on substance material and characteristics and provide information to students that science materials what they learn turns out to be related to the environment and culture around them, with this module students become motivated, active and independent in learning so that their learning outcomes improve. According to Xiao et al., (2018) the increasing of student learning outcome will improve teaching-learning quality.

The results obtained is relevant to the previous research which stated that ethno-science has important role to improve student learning achievement and it is proved from the research data, where students who learned using ethno-science based module for science learning gained N-gain of 0.6 with moderate category (Sudarmin et al., 2017). Furthermore, Setiawan et al., (2017) with Fibonacci and Sudarmin (2014) reported that students who learned using module or learning tools developed by mentioned approach can improve literacy of science, indicated by N-gain score with low and moderate category.

The difference in the value of learning outcomes between the two classes is also supported by the Okwara and Opu research (2017) that there are significant differences in achievement scores and interests of students taught using the ethno-science approach and those taught using demonstration methods, which means that students' achievements and interests are taught with an approach to ethnics higher than students taught by the demonstration method.

C. Student Responses to the Implementation of Ethno-Science-Based Module

Respon Students' responses to learning using ethno-science based modules show that the average response of students from 58 people is obtained by students who choose strongly agree (SS) amounting to 54,24, agree (S) 39,39, disagree (KS) 4,77, and disagree (TS) 1,33. Therefore, it can be said that the response of Banda Aceh Senior High School 8 and 14 students is good and interested in modules based on ethno-science. The student responses are presented in Figure 2.

This is supported by the research of Nisa et al., (2015) that learning with the ethnics module obtained a very good response to the integrated ethno-science module, meaning students were interested in using the module. This is also in line with the research of Fitria and Wisuadawati (2018) who received good responses from students towards the development of ethno-science based books, and research by Amila et al., (2018) that the response to learning using LKPD based on ethno-science was very positive, students were interested in learning to use LKPD with images, cultural phenomena and easily understood material

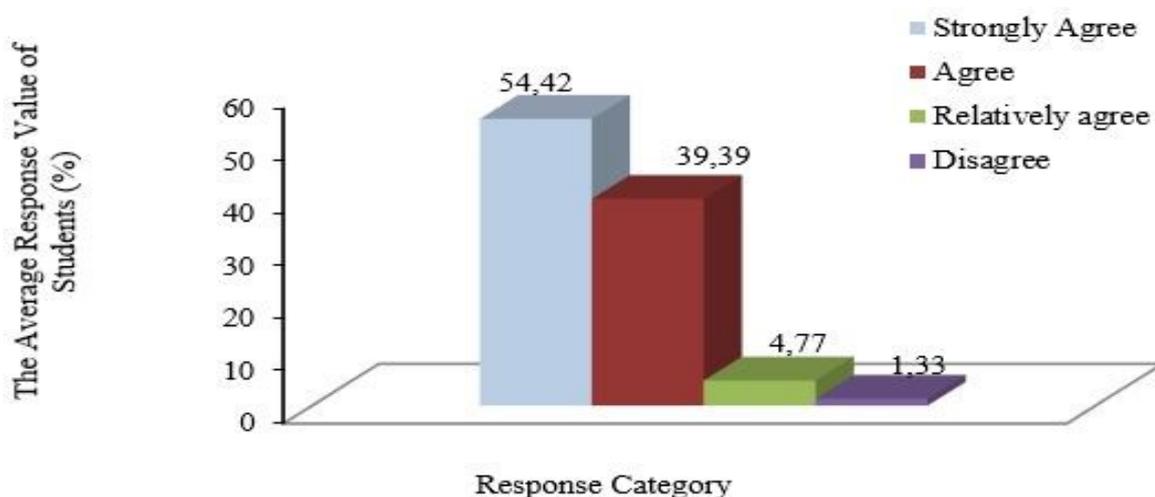


Fig. 2. Questionnaire results of students response.

IV. CONCLUSION

There are several conclusions according to the results:

- 1) The feasibility of ethno-science –based module on material substance and its characteristics based on the validation of science experts and teachers obtained an average score of 92,15 and 92,87% with very feasible categories.
- 2) There is a significant difference between the increase in the learning outcomes of the experimental class and the control class after using a substance module and its characteristics based on ethno-science.
- 3) Students' responses to learning by using ethno-science based modules on special topic of material substance and its characteristics, on positive and interested in the module.

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