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The Influence of Ethnoscience-Based Learning Video to Improve Students' Understanding of Green Chemistry in Integrated Science Subject

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Abstract

Indonesia is a country with a lot of culture and wisdoms. These identities are proudly upheld and maintained by every citizens of the nation. Education plays an important role in preserving these values, including to insert it into classroom activities. Ethnoscience-based learning process is hoped to change teacher-centered learning stigma to a contextual and meaningful learning. This research aims to develop learning video for integrated natural science class with ethnoscience basis and implementation of green chemistry principle for students. The used method in this research was research and development with a 4D modification. The result were obtained from the judgment of experts of media, materials, and ethnoscience. The judgment proved that the media was very properly able to be used. The responses of the teachers and students to the video was very good. The effectiveness of the video was shown with n-gain value of 0.52 or the criterion of medium. Based on the research, it can be concluded that the use of video were very proper to develop students' understanding of green chemistry based on the National Education Standardization Agency.

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INTRODUCTION

Indonesia is a country with cultures and customs. It has prideful identity which is inserted through its education to be maintained by its people, especially in integrated science learning. This behavior and process of local wisdom has been upheld by Indonesian society. The set of knowledge owned by a nation using certain method and procedure as the part of their tradition and proven with empirical study is called as ethnoscience (Ahimsa & Pura, 2007).

Ethnoscience learning is based on the acknowledgment of culture as the fundamental part of education and as a communicative expression to the development of science (Joseph, 2010). Ethnoscience learning can change the teacher-centered learning to be student-centered as a contextual and meaningful learning. Students cannot only understand the materials but also apply it to their daily life. It is more interesting for students to learn natural science as well as to implement it to their environment. This learning also relates local culture as a form of students' cultural appreciation.

The importance of science reconstruction from local culture has not beconcepted textually and formally (Sudarmin, 2014). The most important part of ethnoscience is ethnobiology. Ethnobiology is based on interdisciplinary study about the relation of plants and animals to human's life in the past or now. One of the study in ethnobiology is ethnobotany. It is a field which completely reviews the reciprocal relation between plant and human (Utami & Haneda, 2010).

To date, the learning process only focuses on conceptual learning. The applied learning has not able to make students interested and enthusiats in learning. If this is allowed, students can be more passive and bored with learning. Meaningful learinng can relate new processes and information to the relevant concept of people's cognitive behavior. Education required education facilities and resources that can facilitate the implementation of effective teaching and learning process (Wahyudin, 2010).

To make the learning process meaningful, teacher should always dig concept and integrate it harmoniously with the new knowledge. A concept which can be developed is green chemistry. It is a concept of innovative chemical technology which reduce the use of dangerous chemicals (Nurma, 2008). The principle offers (1) prevention than handling of waste. (2) usage of less waste than cleaning it. (3) choice of correct method to design raw material and minimum additives. (4) choice of raw material of intermediary in the synthetic process as an effort to minimize its toxicity. With the use of save chemical substances, teh use of sgae solvent and additives, and the prevention of pollution and accident. Green chemistry education has formally been initiated in United States of America since 1998, cooperating with Environment Protection Agency (EPA). Until now, American Chemical Society (ACS) has developed some learning materials, handout, articles, and journals regarding green chemistry (Klingshirn, 2009).

To obtain joyful learning environmnet, the learning situation should use innovative learning of science with ethnoscience basis and the development of green chemistry. The superiority of the media are; (1) attrating students' interest to improve their motivation; (2) clearer learning handout which makes them able to learn easily. Imamah (2012) showed that animation video can improve students basic understanding of plants in their daily life.

Therefore, the use of video should be familiar to students' condition, depth of materials, and target of learning (Ali, 2009). Based on the background, this research is going to discoer the effectiveness of ethnoscience based video in integrated science subject to improve students' green chemistry understanding.

METHODS

This research used research and development approach with the modification of 4D models (Four-D Models) (Thiagarajan et al.,

1974) can be viewed in the figure 1. The phases of this research were defining, designing, developing, and disseminating.

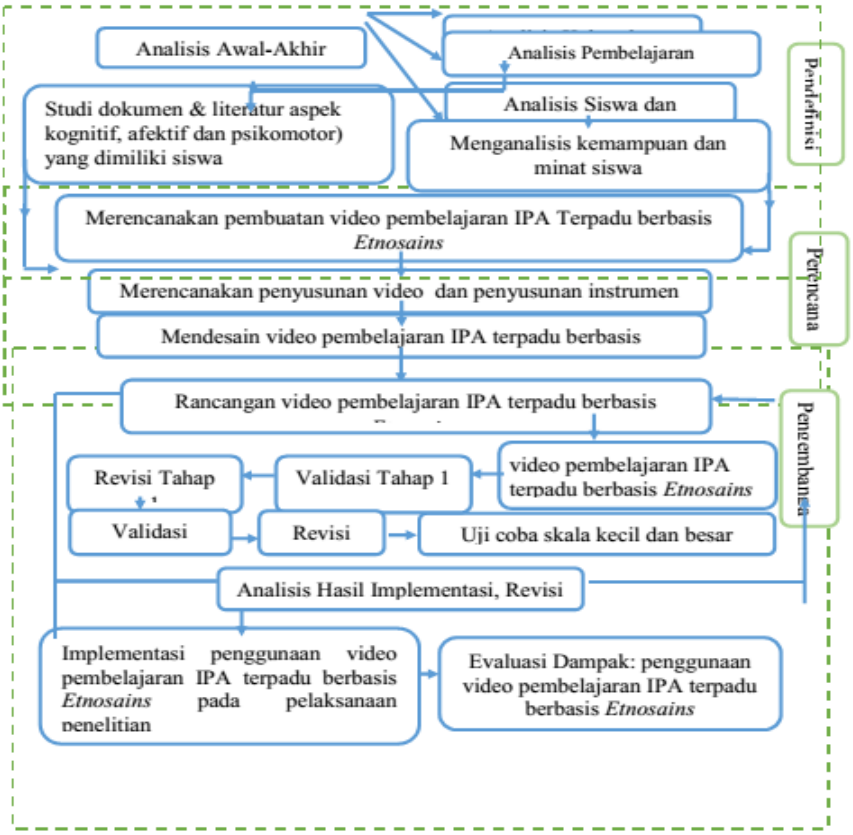

Figure 1. Modification of 4D models (Four-D Models).

RESULTS AND DISCUSSION

The result of the research are the validation of experts, responses of stakeholders (teachers and students), the students' understanding of green principle, and the influence to students learning outcome.

Learning Video Description

Green chemistry is illustrated to make the students understand. There are some pictures, texts, and audios given to make students able to define the concept, can be viewed in the figure 2.

Figure 2. Green Chemistry's Illustration

The learning video shows the production of shrimp paste and presto of milkfish from Juwana, Pati. The production is used as the evidence of the materials, emphasizing on the additives substance of the food. The video shows the production in traditional method with

conventional and eco-friendly tools. In the video, there is also text and audio making the students able to relate scientific process of the production to green chemistry and etnoscience. This video was then set as the supplementary materials for additive substance chapter for VIII grade class.

In the video, the researcher included the materials of green chemistry and ethnoscience. Beside the materials, the researcher asked the students to discuss, interview their parents, and inteview the producer of shrimp paste and presto. Students were also asked to find out the additives in the food as the enhancer of color, taste, and maintenance from the local ingredients, can be viewed in the figure 3.

Figure 3. The Process of Shrimp Paste and Milkfish Presto

Then, students were asked to find the definition, varieties, chemical formula, characteristic, ingredients, function, and danger of the additives to human from its massive consumption. From the discussion, the students can understand the concept and implement it to their daily life.

According to Suastra (2005), original natural science is the part of people's custom which is maintained and believed by people while modern science is related to concepts, principle, and reproducible theories (tested with laboratory experiment) and acknowledged by scientists. In the video, the students knew that most people in Juwana work as business owners of shrimp paste and milkfish presto producer. The ethnoscience of this fact can be seen from the interview to the producers. The producer stated that the use of natural additives have very good quality and eco-friendly. The information of modern science was obtained from articles and journals including the advantage of natural additives, sweetener, preservation, and seasoning.

Experts Validation

The proper test result came from the scoring of modified instruments of learning process implementation. Instrument I consists of materials and integration of it, instrument II is related to media, and instrument III is for the

ethnoscience. The result from experts judgement can be seen in Table 1.

The video was deemed very proper by the experts of media, materials, and ethnoscience. The validator included the teacher of SMP Negeri 2 Juwana and the lecturer of Universitas Negeri Semarang. This research is in line to Perwitasari et al. (2016) that the implementation of integrated material of ethnoscience to science subject in the chapter of fumigation can increase students' literacy level.

Table 1. Recapitulation of Proper Test by Experts

No	Validator	Materials		Media		Ethnoscience	
		Percentage (%)		Percentage (%)		Percentage (%)	
		Validation I	Validation II	Validation I	Validation II	Validation I	Validation II
1	Validator I	89.5	-	93.3	-	91.1	-
2	Validator II	85.9	-	86.6	-	91.6	-
3	Validator III	71.9	84.2	70	90%	79.2	95.9

The video is aimed to make students appreciate and preserve local wisdoms. The understanding of science give positive impact which can improve students outcome. It is in line to Rante *et al.* (2013) that the use of multimedia-based audio video materials eksperimen can make the process effective and practical. The students felt that the learning is easy, interesting, motivating, and challenging for them to do practicum and studying.

The Responses of Students and Teachers

The responses of teachers and students is presented in Table 2. The small-scaled test was done to 15 students in VIII A. Then, the bigger scale test was done to 33 students of VIII C in SMP Negeri 2 Juwana.

Table 2. Recapitulation of Students' Responses to the Video

No	Prompted Aspects	Percentage (%)		Mean	Criteria
		Small Scale	Big Scale		
1	Interest to follow the learning	71.1	82.5	76.8	(Good)
2	Relevance to the context	66.7	84.2	75.4	(Good)
3	Ease to operate video	68.9	83.8	76.5	(Good)
4	Ease to understand additive	71.1	81.8	76.1	(Good)
5	Interesting picture	77.8	84.8	81.3	(Good)
6	New information	68.9	87.9	78.4	(Good)

7	Motivation to Learn	71.1	81.8	76.1	(Good)
8	Effective Learning	66.7	84.8	75.6	(Good)
9	Interest to the Video	80	86.9	83.5	(Very Good)

Based on Table 1, and 2, it can be obtained that the use of the media was prove very proper to improve students understanding upon green chemistry in the percentage of 72.42% in smaller scale test. After the update of the data from students' suggestions, the newer version of the test obtained the percentage of 87.7% in the category of very proper to improve students' green chemistry principles.

Table 3. Recapitulation of Teachers' Responses to Learning Video

No	Prompted Aspects	Score		Mean	Criteria
		Teacher I	Teacher II		
1	Interesting learning	3	3	3	(Very Good)
2	Ease of teaching	3	3	3	(Very Good)
3	The interest to use the video for teaching	2	3	2.5	(Good)
4	Motivation to innovate the learning process	3	3	3	(Very Good)
5	Interesting picture and animation	3	3	3	(Very Good)
6	Logical and systematic materials	3	3	3	(Very Good)

Based on Table 3, it can be obtained that the responses from teacher 1 gained the mean of 94.4% or very proper, while teacher II responded with 100% or in very proper category. It can be concluded that the video was very proper according to teachers' responses.

The Data of Green Chemistry Principles Development

The responses of students is presented in Table 4. The small-scaled test was done to 30 students in VIII A. Then, the bigger scale test was done to 34 students of VIII D in SMP Negeri 2 Juwana.

Table 4. Recapitulation of Students' Responses to the Video

No	Prompted Aspects	Percentage (%)		Mean	Criteria
		Small Scale	Big Scale		
1	Interest to follow the learning	71.1	82.5	76.8	(Good)
2	Relevance to the context	66.7	84.2	75.4	(Good)
3	Ease to operate video	68.9	83.8	76.5	(Good)
4	Ease to understand additive	71.1	81.8	76.1	(Good)

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9	Interest to the Video	80	86.9	83.5	(Very Good)

Based on Table 1, and 2, it can be obtained that the use of the media was prove very proper to improve students understanding upon green chemistry in the percentage of 72.42% in smaller scale test**.** After the update of the data from students' suggestions, the newer version of the test obtained the percentage of 87.7% in the category of very proper to improve students' green chemistry principles.

Table 5. Recapitulation of Teachers' Responses to Learning Video

No	Prompted Aspects	Score		Mean	Criteria
		Teacher I	Teacher II		
1	Interesting learning	3	3	3	(Very Good)
2	Ease of teaching	3	3	3	(Very Good)
3	The interest to use the video for teaching	2	3	2.5	(Good)
4	Motivation to innovate the learning process	3	3	3	(Very Good)
5	Interesting picture and animation	3	3	3	(Very Good)
6	Logical and systematic materials	3	3	3	(Very Good)

Based on Table 3, it can be obtained that the responses from teacher 1 gained the mean of 94.4% or very proper, while teacher II responded with 100% or in very proper category. It can be concluded that the video was very proper according to teachers' responses.

The Data of Green Chemistry Principles Development

The responses of students is presented in Table 4. The small-scaled test was done to 30 students in VIII A. Then, the bigger scale test was done to 34 students of VIII D in SMP Negeri 2 Juwana.

Table 6. Recapitulation of Green Chemistry Principles Development

No	Prompted Aspects	Percentage (%)		Mean	Criteria
		Students of VIII A (Small Scale)	Students of VIII D (Big Scale)		
1	The use of safe chemical substances.	77.8	89.89	83.85	(Very Good)
2	The use of renewable resources.	71.1	85.86	78.5	(Good)
3	Preventing polution.	68.8	88.89	78.85	(Good)
4	Choosing safe additives for daily life	64.4	83.84	74.12	(Good)
5	Agree to prevent than handle thewaste.	80	89.89	84.9	(Very Good)

Based on Table 4, it can be obtained that the responses from students of VIII A (small scale) gained the mean of 72.42 or proper, while students of VIII D (big scale) gained the mean of 87.68 very proper category. It can be concluded that the video was very proper according to green chemistry principles development responses.

The Improvement of Students' Learning Scope

The improvement of students' learning can be seen from the pre-test and pottest. The pre test of the learning obtained the average score of 54, while the posttest average score was 78. It obtained the gain value of 0.52 or in the medium category. It showed that the video is effective to develop students' understanding.

CONCLUSION

Based on the result of the research, it can be concluded that the learning of science using ethnoscience-based video for additive substance to develop green chemistry principle was very appropriate according to the National Standardization of Education Board to improve students' knowledge. This video can be used as the supplementary materials for natural science. The video can be used as a reference to develop learning materials for other materials.

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