



RECONSTRUCT ETHNOSCIENCE BASED-SCIENCE IN KARIMUNJAWA ISLANDS AS A MODE TO BUILD NATURE CARE STUDENT CHARACTER

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ABSTRACT

The aims of study are to : (1) product module of ecosystem material with SETS-vision and Islamic value categorized valid or very valid (2) recognize the use of module toward the cognitive learning outcome of students of MAN Kalimukti Kabupaten Cirebon. This study used Research and Development with model developed by Sugiyono. The population of the study is the class X of MAN Kalimukti which consists of four classes. The class X2 is for small-scale testing. The classes of X1 and X3 are as for big-scale testing. This study showed that: (1) the developed modul has characteristic with SETS-vision and Islamic value categorized entirely valid (2) the developed module can increase students's learning outcome in the subject of ecosystem. Such case has been shown there are mean differences from the result of cognitive posttest between the control with experiment class and classical completeness. Therefore, the module SETS-vision and Islamic value can be applied well at school.

Key Word: reconstruct, ethnoscience, nature care character

INTRODUCTION

Karimunjawa Islands is a Marine Reserve National Park in Indonesia which is located in Central Java province. As Karimunjawa is set as a marine reserve, the local community has found to have moral and socio-cultural ethics and indigenous science as their unique local wisdom which has been ingrained as their pattern of behavior in keeping various marine environments such as marine biota, coral reefs and fauna. The reality at this moment, this community science based on local culture and uniquely local wisdom has not much been studied and revealed, or furthermore implemented as the learning resource to plot the conservation content and nature care characteristic for students. Therefore, if the character of environmental conservation of marine biota and coral reefs, flora, fauna is not revealed and documented, and transferred to the young generation, then one day it will disappear. As a result of lack of attention to the socio-cultural local environment as the learning resource, the concern and the ownership of the local wisdom as our nation character and identity will vanish (Djulia, 2005).

According to the explanation above, this study is intended to reconstruct culture and local wisdom based-science in conserving various marine biota, flora, fauna. This study is expected to contribute to the science field in finding a learning material related to the reconstruction of the culture and local wisdom based-science in Karimunjawa islands. This study can be used as a mode to enrich the concept and the science, as well as a new pattern of knowledge in developing nature care student character. To reconstruct, in this study, refers to Creswell (2009) through the activity of science identification, verification, formulation, accomodation and assimilation of the native community and local wisdom to become scientific knowledge.

It is necessary to build (reconstruct) the native science knowledge and local wisdom based-scientific knowledge in Karimunjawa, since the community of this islands has implemented the conservational pattern of behaviour of various marine biota and coral reefs, flora and fauna in their life, but it is not scientifically formulated and concepted yet. Based on the things above, this study is intended to abstract or developing cultural and local community wisdom based-science in

Karimunjawa to become an established and formal scientific knowledge which will be taught as a material of natural science in SMP, particularly in the Ecosystem material. The cultural based-scientific knowledge will take part in actualizing UNNES identity as an international conservation university.

The transformation and reconstruction of original science to be scientific knowledge as an effort to actualize the conservation of ecosystem, ethnobotany and marine biota had been conducted by Duit (2007). Indonesian scientist, Suastra (2007), had also globalized the community science as a study and also developed a new theory as a learning resource. He also reviewed ethnosience in the Penglipuran Bali community. Djulia (2005) studied about the role of Sunda local culture in forming scientific knowledge for plant photosintesis and respiration in the context of agricultural environment. According to Kidman (2012) it is important to position local wisdom and knowledge in the science curriculum, to develop reinforcement to students' sense of nationalism.

The ethnosience based-learning is absolutely required to improve the awareness of natural resource continuity. Law no. 5 in year of 1990 has regulated about biodiversity conservation, including biodiversity resource management which consists of three acts, that are the protection of life buffer system, the preservation of various plants and animals and their ecosystems, and the sustainable use of biodiversity and its ecosystem. Based on the mentioned law, the community is expected to concern about the importance of biodiversity in their environment. However, Indonesian communities have less concern about their nature and environment. With the implementation of ethnosience based-learning in natural science subject in SMP, the nature care student character are expected to improve.

METHODS

This research used a phenomenology qualitative approach with an approach of ethnosience which is a study about a science organized from the culture and local wisdom related to phenomenons and occurrences found in the local community and wisdom (Battiste, 2005; Creswell, 2009). The setting of this research is mangrove forests and marine park of Karimunjawa islands, particularly coral reefs ecosystem.

The population of this research was the class VII students of SMP Negeri 1 Karimunjawa in the

odd semester of year 2014/2015. This research used instruments such as questionnaires and test sheet. The questionnaire was used to collect data about scientific knowledge in Karimunjawa islands. It was submitted to the teachers and some students to find out their knowledge about mangrove forests and coral reefs ecosystem. The questionnaire was also used to collect data about nature care student characteristic after an ethnosience based-nature science learning was conducted. Test sheet was used to find out students' comprehension before and after the implementation of the ethnosience based-nature science learning about mangrove forest and coral reefs ecosystem.

Some analysis techniques were used to respond to the research problems. The analysis toward the data of the scientific knowledge were documented into one ethnosience based-learning material. The data of the test result was examined by using parametric statistic which used one sample of descriptive t-test and normalized gain test.

The result of nature care students is qualitatively put into the evaluation criteria (Arikunto dan Cepi, 2009) which is presented in Table 1.

Table 1 Nature Care Student Character Criteria

Percentage	Criteria
3,26 – 4,00	Very Good
2,51 – 3,25	Good
1,76 – 2,50	Poor
1,00 – 1,75	Bad

The result of the student grade improvement was used to find out about the influence of the prepared learning material toward the student grade improvement, and it used the following gain modification formula:

$$\langle g \rangle = \frac{\langle S_{post} \rangle - \langle S_{pre} \rangle}{100\% - \langle S_{pre} \rangle}$$

The magnitude of factor-g is categorized as follow:

- High : $g > 0,7$ or stated in percentage $g > 70$
- Medium : $0,3 \leq g \leq 0,7$ or stated in percentage $30 \leq g \leq 70$
- Low : $g < 0,3$ or stated in percentage $g < 30$ (Hake, R.R., 1998).

RESULT AND EXPLANATION

Ogawa (1997) described the reconstruction steps or the establishment of cultural and local wisdom based-scientific knowledge. The description was about to conceptually reconstruct local community and wisdom

based-scientific knowledge through the activity of identification, verification, formulation, conceptualization of scientific knowledge through accommodation, assimilation and interpretation process. Those research stages were the conceptual framework of this research. George (2001) brought up few principals of science on the context of local culture, which are: (a) there has to be a connection between culture and science as the research objects, (b) to be learned native community science must be meaningful and useful in daily life. (c) native community science and common sense take part in the content of science education, (d) traditional original knowledge includes the comprehension of the universe phenomenology, and science, (e) the methodology used has to be able to connect the conventional knowledge to scientific knowledge. These principals are used as the guidelines to reconstruct this scientific knowledge.

Mangrove and Coral Reefs Ecosystem as a Result of Scientific Reconstruction

This study explored about the variety of scientific knowledge in Karimunjawa islands. There were two significant ecosystems for the continuity of the tourism and environment in the Karimunjawa islands, they were mangrove forest and coral reefs ecosystem. The study result of some islands in Karimunjawa found some crops which existed in the Karimunjawa islands, for example Dewandaru, which is presented in Figure1.



Fig. 1 Dewandaru on Karimunjawa islands

The observation in Karimunjawa islands found three variety of rare crops and considered as local wisdom in Karimunjawa, they were dewandaru, kalimasada and setigi crops. Those three crops were special, and according to the interview with some community figures, dewandaru wood existed in the tomb of Sunan Nyamplungan, which was located in the top of the northern hills of Karimunjawa. On its gate, there were two big trees which were known among the community as “Wood of God”. According to public belief, dewandaru wood was sacred. It was said that whoever kept dewandaru at house, he/she would avoid burglars or

criminals. The specialty of dewandaru was that this could not float. Scientifically, this wood had heavier density than water, thus it will be drown. As a result of direct observation to mangrove forest, local wisdom Betah and mangrove forest were found as presented in picture 2.



Fig. 2 Betah Crop in Mangrove Forest Ecosystem

The ecosystem components consist of biotic and abiotic components. Biotic components found in this area were mangrove, birds, fishes, crabs, snails, clams, snakes, and others. The community utilized the biota as protein enhancer food material, for example mangrove crab (Goto) which was used as delicious protein enhancer food. Abiotic components found in mangrove forest were water, soil, rocks, air, and others. The water of this mangrove forest was brackish water which was a good place for mangrove. According to the research conducted in SMP 1 Karimunjawa, many students did not understand the importance of mangrove ecosystem for the environment. Most people in Karimunjawa cut down mangrove trees to be used as construction materials. Thus the ethnoscience based-learning is important to increase nature care character of students.

Aside from its richness of mangrove forest, Karimunjawa was famous for its underwater beautiful scenery. One of the existing ecosystem was the sustainable coral reefs ecosystem. There were two types of coral reefs ecosystem, they were naturan and artificial ecosystem. Some artifial coral reefs ecosystem used as tourism places were menjangan besar, menjangan kecil and parang island.

Coral reefs was an ecosystem in the tropical seabed which was formed by calcium producing biota, particularly coral stone and calcareous algae, along with other biota live im the seabed such as Mollusca, crustacean, Echinodermata, polychaete, porifera and tinucata as well as other biota which live freely in the waters around, including planktons and fishes. Coral reefs were a renewable resource. It was in a form of tropical ecosystem formed by mineral calcite solid sediments or calespar or bioclastic limestone which was generated bu coral and calcareous algae, which were also a habitat for some marine biota to breed, grow and

associate in a balance life system so that coral reefs could be considered as marine tropical forest.

The interview result to some students showed that some villagers were still not be able to protect the sustainable coral reefs. Some people still used explosives to fish, which was feared would damage coral reefs ecosystem. Moreover, some people took coral reefs for sale as aquarium decorations.

Nature Care Student Character

Questionnaires were used to find out student character after the implementation of Natural Science learning using developed ethnosience based-learning material in Karimunjawa islands. The result of the questionnaires is presented in Table 2.

Tabel 2 Student Character After Ethnosience Based-Learning

No	Statement	Mean	Remarks
1	After learning ethnosience based-natural science, willing to protect the environment	3,4	Very good
2	After learning ethnosience based-natural science, willing to plant the environment	3,6	Very good
3	I always seriously caring for any plant in Karimunjawa islands	3,4	Very good
4	I never damage plants in Karimunjawa islands	3,3	Very good
5	I always put garbage in its place	3,4	Very good
6	When finding garbage in places, I take and put it in its place	3,3	Very good
7	I separate organic and anorganic waste when dispose it	3,1	Very good
8	I organize my class environment carefully so it will be neat and clean	3,3	Very good
9	I never do vandalism on the walls in Karimunjawa islands	3,3	Very good
10	I always try to show my love for nature after knowing its benefits	3,5	Very good
	Mean	3,4	Very good

Student Learning Result

This study showed student learning result of mangrove forest and coral reefs ecosystem questions, which we use to find out the effectiveness of this ethnosience based-natural science learning. Based on score analysis for pre test and post test which were conducted before and after ethnosience based-natural science learning and characters, the result is presented in Table 3.

Tabel 3 Evaluation Result Of Teaching Aspect

No	Result	Pre-test	Post-test
1	Mean	55	75
2	Highest Score	60	95
3	Lowest Score	30	60
4	Completeness (%)	25	90
5	Incompleteness (%)	75	10

Table 3 above shows the result of learning for pre-test and post-test. The mean score for pre-test is 55 with the completeness of 25% (7 students), meanwhile the percentage of student’s incompleteness is 75% (23 students). The mean score for post-test is 75 with completeness of 90% (27 students), meanwhile the percentage of student’s incompleteness is 10% (3 students).

An analysis of mean score increasing for pre test and post-test was examined by using normalized average gain formula, and the result is:

$$\begin{aligned} \langle g \rangle &= \frac{\langle S_{post} \rangle - \langle S_{pre} \rangle}{100\% - \langle S_{pre} \rangle} \\ &= \frac{75 - 55}{100 - 55} \\ &= 0,44 \end{aligned}$$

Score $\langle g \rangle = 0,44$ means the increasing of mean score of pre test and post test categorized as medium, where the score is $0,3 \leq g \leq 0,7$.

The result of the research data analysis showed that ethnosience based-scientific knowledge had been formulated and concepted as a natural science learning in SMP Negeri 1 in Karimunjawa islands. The referred learning resource was mangrove forest and coral reefs ecosystem. Students studied by using ethnosience based-natural science learning resource to build nature loving student character.

Based on the pre test result of coral reefs ecosystem, most students had known the definition of coral reefs. From the post test result, students could explained that coral reefs was a place for sea animals to live, to breed and to forage. For question no. 2 about an area which was rich for its coral reefs, most students already answered karimunjawa, menjangan kecil, menjangan besar, parang, tanjung gelam, and kerakal islands, which were indeed the answers. For question about how to keep the coral reefs sustainable, students’ answers were by not stepping down on the corals and not using explosives to catch the fish. For question about benefits of coral reefs, students answered that it was used as a living place for sea animals. For post test, students gave various answers such as place for fish to live, to decrease the abrasion and for tourism beauty. The students felt that coral reefs ecosystem must be protected for the sake of tourism in Karimunjawa islands.

The pre test result for mangrove forest ecosystem showed that the students had found out the local name of the mangrove, which was called betah. For pre test questions, they did not understand about biotic and abiotic components, individual and population, the definition of natural and artificial ecosystem as well as

the examples. The post test result showed that most students had correctly answered about biotic and abiotic components of mangrove forest. Students had been able to differentiate the individual and population of mangrove forest. Students also had been able to explained about the definition of natural and artificial ecosystem and their examples.

The analysis of the nature care students character questionnaire, after the implementation of the ethnosience based-learning, earned a good response. From the whole 10 questions, 9 of them earned very good score and 1 of them earned good score. The lowest mean score of 3,1 came from question no.7 (I separate organic and anorganic waste when dispose it). The highest mean score of 3,6 came from question no. 2 (After learning ethnosience based-natural science, willing to plant the environment).

The effectiveness of the learning material of this study was shown in the student learning study which consists of questions about mangrove forest and coral reefs ecosystem. Based on the score analysis of pre test and post test which were conducted before and after natural science learning by using conservation and carácter modul, the mean score for pre test was 55 with the study completeness of 25% (7 students), while the percentage of the incompleteness was 75% (23 students). Post test mean score was shown at 75 with the completeness of 90% (27 students), while the percentage of incompleteness was 10% (3 students). Score (g) = 0,44 meant that the increasing of pre test and post test mean score was categorized as medium. This increasing score from pre test to post test showed that the ethnosience based-ecosystem learning material was effective and suitable for natural science subject for class VII, which was about ecosystem.

This study result was proven similar to the one conducted by Weni (2013), which stated that the modul of relationship among ecosystem components in help of flashcard was good and able to build environment loving character. According to teachers, the use of the modul of relationship among ecosystem components in help of flashcard which was added with environment loving education was very good. The reason was that it could improve student's knowledge about natural science particularly ecosystem subject, gave motivation for students to study during the learning period. Moreover, it could teach students to build environment loving character.

The study of Sudarmin dan Arif (2012) about the development of conservation learning modul for natural science subject to build natural loving student character also showed the same result. The analysis of student's care for the environment in SMP Negeri 30 Semarang showed very good result. It was due to the context of the conservation and environment modul could lead the students to care and protect more of the environment.

The nature care student character in this study gained a mean score which categorized as very good. According to the study result, students had understood the needs to take care of the coral reef and mangrove forest ecosystem. They did not put garbage on its place in their daily life. But after getting ethnosience based-learning based on observation, the bad habit of throwing out garbages slowly changed for goof and they even started to put away any found garbage to its place. This result was in accordance with the study result from Khanafiyah & Yulianti (2013), which stated that learning was begun by showing environmental issues and was continued by conducting an active discussion in the Environmental Physics subject, which resulted to the increasing care toward the environment.

In Indonesia, science subject are taught in integrated ways that cover physics, biology, chemistry and astronomy categories (Widiyatmoko and Sita, 2014). This statement connected with ethnosience based-scientific knowledge had been formulated and concepted as a natural science.

Character is a nature, behavior, moral and personality of a person which is formed from the internalization of goodness, which is considered as a point of view, think and behave. In this study, the character was still categorized as low, which can be seen on table 4.1, due to some limitations happened during the research. The research was only conducted twice. A person's character can not be changed in a short time. It needs a long time and process as well as many factors to change a character. Therefore, this study is only a small part of a long process to develop a better character of student. Kemendiknas (2010), stated that the development and the establishment of a character needed an transferred exemplary development, intervesion through learning process, training, a long terma continuous habituation and reinforcement which was accompanied by noble values. Therefore, character education is a result of a long process which moves step by step and must be started in early age.

CONCLUSION

According to the study result which is related to reconstruct ethnosience based-scientific knowledge with ecosystem subject, the conclusions are: (1) conclusive result of this study is that ethnosience based-natural science has been scientifically formulated and concepted as a natural science learning resource in SMP Negeri 1 in Karimunjawa islands. The referred learning resources are mangrove forest and coral reefs ecosystem, (the ethnosience based-natural science learning is effective

to be used to build nature care student character in SMPN 1 Karimunjawa.

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