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The Mapping of Indigenous Knowledge of People at 3T (Frontier, Outermost, and Least Developed) Regions as an Ethnoscience Study

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Abstract: This research intended to map indigenous knowledge of people in the frontier, outermost, and least developed regions or generally referred to as 3T (*Terdepan*/Frontier, *Terluar*/Outermost, *Tertinggal*/Least Developed) regions. This research employed a qualitative research approach through a descriptive method in which an experimental method was performed for mapping the indigenous knowledge. The target mapping area was Papua, Aceh, West Kalimantan, and East Nusa Tenggara. Geographical position, research funding, and time allocation became the main considerations in selecting these areas. The four 3T regions are said to be the most appropriate as the locals remain to believe and apply their indigenous knowledge. The mapping results found that several indigenous knowledge is potentially tested scientifically in labs, they are *Bakar Batu*, *Tanam Sasi*, and *Honai* in Papua; *Rumoh Aceh* and *Batu Nisan* in Aceh; *Berjuluk Baatutuk* and *Betang Radang* in West Kalimantan; and *Ebang* and *Welang* in East Nusa Tenggara. There are numerous traditions found in the research location, yet those that do not have met the criteria of scientific objects, such as myths and legends, were not included. The mapping results were followed by confirming the opinions of prospective science teachers obtained by 85 % of 54 students who were interested in this finding as a study of ethnocentric The research concluded that the indigenous knowledge of people in 3T regions are unique and required to be further examined scientifically and could be reviewed as a source for Ethnoscience course. This research recommendation is that in science learning, especially in the 3T region should pay attention to efforts to change traditional knowledge into scientific knowledge through integrating the mapping of indigenous knowledge as the content of ethnoscience.

INTRODUCTION

Traditional knowledge is part of the life or culture of a community that is still maintained and believed to be true. The existence of this knowledge is supported by the people's experience that has been told for generations through adaptations to the natural and cultural environment. Sources of traditional knowledge are found in rural areas where sustainability is maintained it is called indigenous knowledge (Lee, 2018; Zefferman, 2018). Indigenous knowledge, which also referred to as local wisdom, defines as a human effort to act and behave toward a particular thing rationally, object or event happened in his/her surrounding (Ademowo & Nuhu, 2017; Aikenhead & Ogawa, 2007). Etymologically, wisdom is understood as a person's ability to use his

mind in acting a result of an assessment of something, object, or the occurring phenomenon. Specifically, local refers to limited interaction space with a limited value system. It acts as an interactive space that has been designed in such a way that it involves a relationship pattern between human-human, or the human-physical environment (Darmadi, 2018).

The 3T regions is a lagging, leading, and outermost area in Indonesia. Most of the 3T areas serve as Indonesia's border gate. The location of the area which is far from the provincial capital makes economic growth hampered due to uneven infrastructure development. Its long way from province capital has caused its access limitation both in information and the technology which resulted in a community's high dependency on nature. Moreover, they remain to uphold local wisdom as an inheritance. The 3T regions are gates that could be easily influenced both internally and externally. Therefore, geopolitically, the 3T regions are so-called gray areas as it is located directly opposite the territory of another country. Lots of problems appear, one of them is its enormous potential that has not been optimally utilized so that it has always been categorized as remote, isolated, and least developed regions (Bello-Orgaz et al., 2016; Suciati & Ariningsih, 2016). Those facts make the 3T regions a potential ethnoscience object.

Ethnoscience is one of the courses learned by pre-service science teachers. It discussed indigenous knowledge of the community that could be scientifically examined. Myths and legends are not included as they cannot be tested. Who stated that science as scientific discipline review natural phenomena having real objects, it is out of the believed myths existed in society (Boon & Van Baalen, 2019; Gandolfi, 2018; Rider, 2019). In the context of ethnoscience, the truth of science is obtained after going through a process of scientific testing which aims to gather scientific truth from indigenous knowledge. Reconstruction is a method used in testing the knowledge and making it into scientific one (Nakamori, 2013; Sumarni et al., 2016).

An analysis of the experts' research findings published in various internationally reputed journals has made clear that concept reconstruction could be done by gathering information and data of field observation to be re-organized and examined (Yemataw et al., 2016). Information about various real practices in a community is an essential part of the process of exploring indigenous knowledge (Johnson et al., 2016; Natuhara, 2018). Knowledge reconstruction is needed to transform traditional knowledge into scientific one; besides, to unveil its feasibility as a learning source in the educational process (Devkota et al., 2017; Morton Ninomiya et al., 2017). Indigenous science incorporates traditional knowledge and Indigenous perspectives, while non-Indigenous scientific approaches are commonly recognized. Indigenous peoples have been responsible for the development of many technologies and have substantially contributed to science (Popp, 2018). Science is the pursuit of knowledge. Approaches to gathering that knowledge are culturally relative.

The changes in the rural community's lifestyle are taken into account as a thread for natural resource and cultural conservation that has been inherited for generations. They used to rely on nature yet the development of transportation access, in addition to technology, is feared to shift natural lifestyle. Cultural shifting of a community is caused by modernization which results in an elimination of environmental friendliness (Fan et al., 2018; Geng et al., 2016; Khusniati, 2014). In other words, the findings of future research have strengthened the concern about resource preservation in the 3T area. Mapping of the indigenous knowledge of people in the

3T region as ethnoscience studies has not been done before. Meanwhile, this is very important as a basis for exploring the original knowledge of the community especially the 3T community by reconstructing the indigenous knowledge through science integrated learning to be meaningful.

This study's aim has explored the indigenous knowledge of the 3T community by reconstructing the indigenous knowledge found. This research was expected to see new scientific knowledge from the reconstruction to conserve local knowledge in the 3T regions. The reconstruction results were confirmed as new scientific knowledge whose truth can be accounted for because it was discovered through a scientific process. The study also revealed the opinions of prospective science teacher students to get a response when the findings were used as material for ethnoscience studies. This opinion is important to determine the follow-up stages of findings in the form of textbooks to develop ethnics studies. (Geesa et al., 2019; Vossen et al., 2019) a positive attitude towards learning study material has an impact on the willingness to learn so that the achievement of learning objectives is more optimal. The attitude data of prospective science teacher students revealed in this study include; interested, curious, as study material, useful, and confident to learn.

METHOD

This study employed a qualitative research approach adapter from (Sugiyono, 2015; Suliyanto, 2018) and (Alase, 2017) through a descriptive method in which an experimental method was performed for testing the indigenous knowledge. The adopted descriptive method referred to find facts and data about indigenous knowledge held by communities in the 3T regions. Traditional knowledge fulfilling scientific criteria was studied in the laboratory to obtain empirical data as a stage of scientific examination so that the truth acquired can be scientifically accountable. However, this article did not convey the results of laboratory testing of the research object. The mapping of the original knowledge found is given to prospective science teacher students through ethnoscience learning to get opinions on the importance of findings as learning.

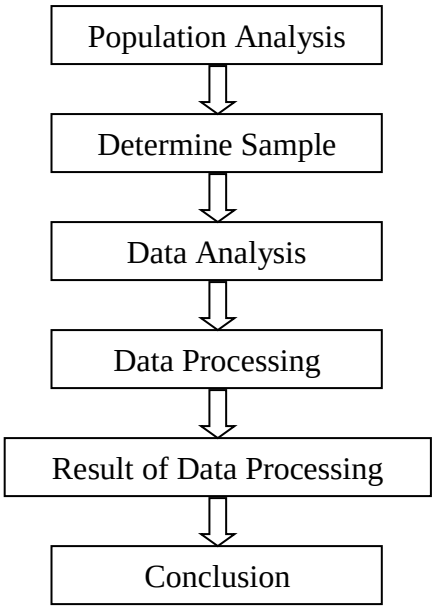

Figure 1. The Descriptive Method Stages adapted from (Sugiyono, 2015)

The research target was folks in five 3T regions; Papua, West Papua, Ache, West Kalimantan, and East Nusa Tenggara. A consideration of geographical location, research fund, and research duration underlie the selection of the areas. Besides, those five are the most strategic ones. The research object was limited to the people who remained to uphold and implement indigenous knowledge. Moreover, myths, beliefs, and legends were not included as the research object.

Science Integrated Learning (SIL) model was adapted to this research particularly in reconstructing the knowledge. The SIL model has been chosen and applied because it has a

reconstruction phase and integrates the results into contextual and adaptive scientific material with the 3T sociocultural society. The steps include observation, interview, documentation study, and laboratory testing. The observation was done in two ways; indirectly and directly. The indirect observation was performed through an analysis of information related to indigenous knowledge provided on the internet while direct observation was carried out during research site visitations. The interview was done with traditional leaders having competencies to dig out information. Traditional leaders in this context relate to village leaders, customary/tribal leaders, religious leaders, or respected and/or respected figures in certain community groups. The documentary study was conducted in the form of picture taking and, video recording on the object of indigenous knowledge. The observation and interview were done by students of Universitas Negeri Semarang who joined the 3T Affirmation Program. The collected data contained tribe names, geographical locations, and types of indigenous knowledge.

Furthermore, laboratory examination intended to found scientific data as a requirement for indigenous knowledge. Only one object was taken from each region to be tested, taking into account the research fund. The observation, interview, and laboratory testing results were analyzed descriptively to elaborate the traditional knowledge. However, this study only presents a mapping of original knowledge in 5 (five) research locations while the lab testing results are investigated further.

The attitude of prospective science teacher students was revealed through a questionnaire that has been tested for validity and reliability by the expert's judgment. It has 4 scales starting from strongly agree (score 4), agree (score 3), disagree (score 2), and strongly disagree (score 1). All prospective teacher students who were the research target filled out the questionnaire. The first confirmed interest is to ensure that the results of the original knowledge mapping have an attraction to be studied. After students are interested, the level of curiosity was revealed through a questionnaire to find out how many prospective teachers want to study. The purpose of revealing the original knowledge of the community among the resulting outcomes in the form of ethnoscience teaching materials is to confirm the attitude of prospective teachers if the mapping findings were used as teaching material. The confirmed utility is linked to the form of benefits gained when studying.

Prospective teachers were also confirmed about the level of confidence they could learn from the community's original knowledge. Questionnaire data were analyzed descriptively and presented in graphical form. Interviews method also used to collect data from the traditional leaders intended to fathom the community's and tribe's background to conserve the indigenous knowledge. Interviews data were analyzed descriptively and presented in table form.

RESULT AND DISCUSSION

The observation results as seen in Table 1 unveiled three types of the main information about tribe names, geographical location, and kind of indigenous knowledge.

Table 1. Tribe Names, Geographical Location, and Kind of Indigenous Knowledge

Tribe	Geographical Location	Kind of Indigenous Knowledge
Dani and tribes in the hinterland of Papua	The Valley of *Baliem*, *Paniai*, *Nabire*, *Pegunungan Tengah*, The Mountain of *Jayawijaya*, *Dekai*,	*Bakar Batu*, *Tanam Sasi*, and *Honai*

Tribe	Geographical Location	Kind of Indigenous Knowledge
	Yahukimo	
Aceh	The North and East are bordered by the Malacca Strait, south of the Province of North Sumatra and the West with the Indonesian Ocean	Traditional house of *Rumoh Aceh*, and *Batu Nisan* (gravestone)
Dayak	West Kalimantan, the North is bordered by Sarawak, Malaysia, while the West is bordered by Natuna Sea and Karimata Strait	*Berjuluk Batutuk*, and traditional house of *Betang Radang*
Kedang	Inhabiting the eastern end of Lembata Island	*Ebang*

The mapping results revealed the indigenous knowledge that could potentially be tested the laboratory for scientific truth, namely; Papua (*Bakar Batu*, *Tanam Sasi*, *Honai*), Aceh (*Rumoh Aceh*, *Batu Nisan*), West Kalimantan (*Berjuluk Batutuk, Betang Radang* traditional house), and East Nusa Tenggara (*Ebang, Welang*). There are other traditions found in the research site, yet some of them are categorized as mythical do not meet the criteria as a scientific object of knowledge.

Interviews with the traditional leaders intended to fathom the community's and tribe's background to conserve the indigenous knowledge. The interview results are presented in the following Table 2.

Table 2. The Interview Results

Tribe	Interview Results
Dani and tribes in the hinterland of Papua	*Bakar Batu* (stone-burning ceremony) It is about maintaining ancestral heritage. The value does not lay on what object is burnt, but togetherness emerges during the ceremony. We used the hot stones to grill pork. We think that this way of cooking makes the meat becomes tastier and more tender. *Honai* It is a traditional house of Papuan. It has a circular shape and is surrounded by a wooden fence as a mark of the owned area. Its shape protects them from strong wind and wild animals; it also, gives warmth to the owners.
Aceh	*Rumoh Aceh* The house's uniqueness is in its open house poles so that it will not be washed away by a flood. Also, the strength of palm fiber as the house's skeletal joints gives flexibility so that it is shock-resistant.
Dayak	*Berjuluk Batutuk* It is a tradition of pounding rice to get rice and rice flour traditionally. This method has been carried out for a long time by the community to obtain food ingredients used in traditional ceremonies. *Betang Radang* traditional house This traditional house is commonly situated in riverbanks which symbolizes the people's closeness and appreciation to nature. The house is built tens of centimeters above the ground, leaving a large underneath space that protects them from wild animals.
Kedang	*Ebang* We use the house not only as a place to live but as a place to store the harvest. Usually, foods such as rice, corn, beans, soybeans are stored in attics which are divided into small rooms made of bamboo or wooden slab.

From the opinion of prospective science teachers obtained, 85 % of 54 students were interested in this finding as a study of ethnoscience learning. The results of the questionnaire analysis about the attitudes of prospective teacher students are shown in Figure 2.

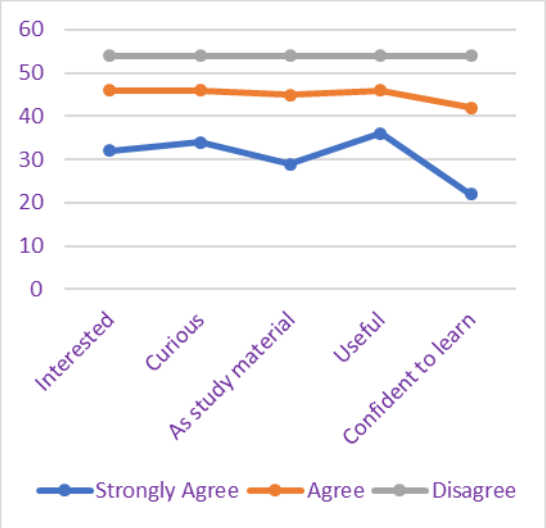

Figure 2. The attitude of Prospective Science Teacher Students

The researchers decided not to further investigated *Tanam Sasi* because, based on the information gathered, it belongs to a spiritual ceremony. Similar to this, *Batu Nisan* traditional form, which has been inherited by the Aceh tribe, was categorized as sculpture art developed in the past. Therefore, those two traditions cannot be tested scientifically as they do not meet the criteria of a scientific object. Explained that scientific knowledge must have a real object or logic phenomenon (Boschiero & Wray, 2018; Roberts, 2016). In other words, those two traditions may be considered as true based on the people's beliefs yet not to be studied scientifically.

The mapping of indigenous knowledge was a preliminary study before reconstructing it into scientific knowledge. The field observation revealed that several tribes strongly uphold their inherited traditions. There is a belief that if a particular ritual is left, the region will be crushed by disaster (Sukri et al., 2018). This belief is due to the community's experience which is always connected to violations of tradition. On the other hand, this research studied the scientific truth without condemning people's beliefs for instance, Papua's *Dani* Tribe who remains to conserve their *Bakar Batu* ceremony. After being studied scientifically, the hot stones burnt during the ceremony could emit pork's appetizing aroma resulting in delicious, tender meat. The concept of cooking is similar to today's electric stove, i.e., cooking without direct fire yet the community does not have an idea of science concepts contained in the ceremony. Another ceremony observed in this research was *Berjuluk Batutuk*, a rice pounding ritual. The shape of the mortar, smash tool, and the pounding way could be studied further to obtain scientific knowledge.

The uniqueness of tribes in Papua hinterland could also be seen from their house form or so-called *Honai*. It is a circular house with a thatched roof. Many people say it looks like a mushroom. The *Honai* house itself was deliberately built consisting of only a small room and a window to hold the cold mountains of Papua. Its materials, shapes, and construction may have many more scientific facts to be studied. The uniqueness of traditional houses is also seen from *Rumoh Aceh*, Aceh's traditional house. *Rumoh Aceh* is a pile dwelling erected over posts that rest on flat stones or concrete plinth. It is constructed of timbers, topped with a wooden gabled roof that is covered with either thatched palm leaves or corrugated metal. Furthermore, it has open house poles that could protect the house from a flood. Besides, its skeletal joints which are made of palm fiber give the building flexibility so that it was shock resistant. The secret of knowledge found in *Rumoh Aceh* lies in the pillars of the house and the connections between the house frames that can be studied scientifically.

Betang Radang house of Dayak tribe is mainly built along the riverbanks stands tens of meters above the ground to avoid wild animals' assault and protect them from a flood. Moreover, *Ebang* house of *Kedang* tribe, East Nusa

Tenggara, does not function only for a living place but also harvest storage. It has a huge attic separated by wooden slab/bamboo into several booths. Unconsciously, the community builds their house following the surroundings natural and cultural conditions. Socio-cultural processes become part of transactions that include the integration of the human environment. The psychological and socio-cultural conditions of the people are connected with mutually changing varieties both in the natural environment and in construction. Therefore, scientific studies could be carried out to investigate them. This research does not cover all regions determined as the 3T regions, which becomes the weakness of this study. However, it has unveiled the indigenous knowledge that needs to be preserved as an ethnoscience course. Highlighted the importance of cultural integration into scientific study, which could be done through concept reconstruction as a result of laboratory testing (Parmin et al., 2016; Suastra et al., 2017). This study will be continued to the lab examination to validate the concept that will be used as a learning source.

Prospective science teachers have a positive attitude towards the results of mapping original knowledge when used as material for the study of ethnoscience. This attitude is known from most that have an interest in inquiry learning because something new turns out to be able to increase curiosity. Students feel confident that they can learn if the mapping of original knowledge is used as material for the study of ethnoscience. Mapping in this research is part of the conservation of natural resources integrated into the scientific culture of traditional societies. Prospective teacher students have a great interest in enriching learning resources through the discovery of science content in their environment. Learning resources from the environment have a stronger appeal in learning (Kleftodimos & Evangelidis, 2016). This research recommendation is that in science learning, especially in the 3T region should pay attention to efforts to change traditional knowledge into scientific knowledge through integrating the mapping of indigenous knowledge as the content of ethnoscience.

CONCLUSION

Various local wisdom has been found in the 3T region and is managed by the community and at this time are threatened by modernization. The mapping of indigenous knowledge is an effort to conserve people's culture, and the obtained data need lab testing to be reconstructed into scientific knowledge. This reconstruction is useful for enriching ethnoscience study for cultural conservation. It is recommended that in science learning, especially in the 3T region should pay attention to efforts to change traditional knowledge into scientific knowledge through integrating the mapping of indigenous knowledge as the content of ethnoscience.

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