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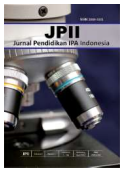

SKILL OF PROSPECTIVE TEACHER IN INTEGRATING THE CONCEPT OF SCIENCE WITH LOCAL WISDOM MODEL

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ABSTRACT

Learning science is not limited to review the concepts, but also strengthen the identity of a nation that has diversity of cultures. Science learning objectives that have been set in Indonesia are students are able to apply the science wisely, maintain and preserve the cultural survival. The study aims to measure students' ability to relate concepts of science with local knowledge by using mind maps that is compiled individually. The result shows that 85% of prospective teachers are able to determine the relationship of science and local knowledge correctly. They are able to link the two domains, through the literature review, observation and interviews.

Keywords: Students, Prospective Teacher, Science, Local Wisdom

INTRODUCTION

Some different opinions occur about the integration of the science concept and local knowledge among educational researchers, some still think that science as a field of education is not related to culture. Meanwhile, everyday students learn science to study the nature. All phenomena of nature in the physical and non-physical forms are continuosly studied. Local wisdom is a genuine knowledge of the society, for some people it is highly contested, because the dominant view of the position of western science as the most powerful knowledge and useful system. Science that ignores the contribution of culture is not appropriate learning for students in Indonesia. Past cultural values applied by the ancestors, have proven capable of maintaining environmental balance. Students, who are studying science in Indonesia, can not be separated from values developed in the community, because of diverse ethnic and cultural backgrounds.

This study aims to reveal the skill of prospective science teachers in integrating science with local knowledge. Measuring students' ability to link the two domains can be used as indicators of students' views about the relevance of both aspects. So, when they become a teacher, they are expected to be able to integrate science and local knowledge then it will result the wider impact of science concept mastery at the same time also strengthen national identity. The problem of learning science in Indonesia is linking between scientific concepts and local knowledge. The results of observation of science learning in schools showed that most teachers have difficulty to link the concept of biology, physics, chemistry, earth and space and local knowledge because the heritage of past knowledge and the field of science studies in secondary schools in Indonesia are taught separably. Therefore it should be taught integratedly to create a new problem analysis. Theoretically, the concepts are united by the theme. It will be easily understood by students, if it is built

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from the habits that exist in the society. Science is learning about natural human activities in the community to form a habit of tradition and pass down through socialization and representation.

Culture is potential to be developed in learning science. Physical environment and social culture have a variety of potential aspects that can be integrated as supplementary teaching materials of science. The physical environment is potential due to the diversity of flora and fauna and the application of simple technologies used in the society. The use of the local wisdom in the learning process does not merely assert science learning concepts but also strengthen the national identity that has diverse cultures. This reaches science learning objectives that have been set in Indonesia of the student is able to apply the science wisely to maintain and preserve the cultural survival. Quality of the human is achieved through an appreciation of the potentials that exist in the environment (Wang and David, 2002).

Culture is a complex concept system, include; values, norms, beliefs and practices thatis handed down from generation to generation (Gondwe and Nancy, 2014). Culture system is how to see, interpret and understand nature. Culture is built and inherited by members of the group through the process of socialization and representation. Indonesian society has a variety of traditions, habits, and values of life that has been used for generations as a guide, which in the past has proven capable of maintaining environmental balance. Lately, the occurrence of natural disasters, such as landslides, floods, and wildfires become a unique phenomenon, what is the scientific study for this. Some habits and values possessed present in people's lives and survive in a sustainable manner.

The scope of science consists of living things, elements, energy, earth and the universe. No matter how strong the concept achievement of science, if people do not respect indigenous values of environment, they will tend to be scientific experts who do not care about the environment. Cultural background of students also has a greater effect on the learning process, it contributed by the provision of teaching materials (Wahyudi, 2003).

Some studies have been conducted before for example the study of Etnoscience course followed by prospective science teachers of Semarang State University. It shows that students had difficulty in making the connection between science concepts with local wisdom in preparing integrated teaching materials. It was less than 20% of integrated teaching content materials prepared by the students. Integrating local wisdom does not reduce the understanding of science concepts, however it can add the meaningfulness of the concept. Students can learn science by using more objects found in the environment, and the selection of objects is adapted to the needs and understanding of the concept and learning styles (Ameyaw, 2011).

The experience described by Lee, *et al*. (2012) said that ethnographic study of indigenous knowledge in Taiwan recommends that to motivate students' interest and improve the performance of school, teachers should use the students' view of collective knowledge based on local and western knowledge. Teaching science by connecting cultural value and modern science has a good relationship especially when teaching science for students from indigenous communities (Cobern and Loving, 2000). Contributions are increasingly powerful in shaping the understanding of the relationship of indigenous knowledge society and science education provided through the students' view who come from the original source of knowledge society (McKinley, 2007).

Revealling ideas from local communities can strengthen the regional nature of meaningful learning and encourage students to be wise to solve the problems of life by combining thought and feeling. Information required often used in everyday life is easier to understand (Cimer, 2007; Schonborn and Bogeholz, 2009). Teaching materials that simply contains the concept will produce a generation that does not preserve the local culture as a pillar of national identity. Culture value in the society clearly has proven capable of maintaining environmental balance therefore it should be used as material in the development of science teaching materials.

There are several factors that influence students' attitudes toward science, they are: teacher, learning environment, classmates, gender, mindset, curriculum, and parents (Scanleburry, *et al*. 2001). The previous experience of science learning shows that the process is effective and positively influences the attitudes toward science learning (Osborn, 2003). The students' ability to learn from their ability to choose a strategy relies on the awareness and indigenous knowledge. The cognitive achievement of students increased because of the motivation and strategy in learning process (Tosun and Taskesenligil, 2011).

Prospective teacher should focus on exploring on applicative skills, development of thinking skills, curiosity, and development of caring and responsible attitude towards the social

and natural environment. The introduction of surrounding natural environment and a variety of advantages over the archipelago can be done through the science learning process. Students can gain direct experience and increase the power to receive, keep, and apply the concepts that they have learned. Conceptual integrated science of physics, chemistry, earth science, astronomy, and biology is presented for students to understand science as a whole, but it should be integrated with social values. Conceptual idea is a foundation in supporting and integrating the various fields of science studies (Hewitt, *et al*. 2013).

Based on the elaboration of the principles of curriculum development in Indonesia for science learning in junior high school level, it is advisable to conduct an integrated learning. The integration of science concept is one of the principles in curriculum of 2006 and 2013 (recent curriculum). Integrated learning is an approach of learning that allows students individually or in groups actively searching, digging, and finding overall concept of multiple areas of study holistically through authentic learning. The integrated learning is appropriate to be applied for students who have the curiosity of various viewpoints.

RESEARCH METHOD

This research applied case study approach to gain an understanding of prospective science teachers in connecting science concepts and local wisdom. The study was started from the identification of the origin area of students, they came from various ethnic groups that consisted of 29 Javanese, 3 Sundanese, 3 Betawi, 2 Minang, and 1 Batak.

Data were collected by using mind maps to measure students' ability to relate science concepts and local wisdom. The ability of students to design a mind map containing key words of science concepts and local wisdom was analyzed based on the broadness, depth, and relevance. The mind maps are created using colored ink to facilitate the participants to pay attention to the words and lines. The participants were 38 students of 5th semester, currently studying Integrated Science Course. They aged ranged from 19-21 years.

The use of mind maps involving students is to uncover the words around science concepts and local wisdom as the result of the identification. The mind maps were provided to measure the conception of students' idea. The broadness of the idea was measured from the amount of words and the correctness of those words, the depth was measured from the ability to create advanced words of the idea, and the relevance was measured from the ability to connect or make connection in the form of lines between science concepts and local wisdom. Each student was given a blank A4 paper and 2 pens with different 2 colors, they were asked in particular to think about the concept of science and local wisdom, and given 60 minutes to complete the mind map. Audio-visual recorder was used to record student discussion when conducting learning activities.

RESULTS

This research has collected several data, they are students' ability to define the concept of integrated science, identify the appropriate local wisdom related with certain scientific concepts, and relate the concept of science with local wisdom by analyzing students' mind maps. Mind map produced by students in identifying scientific concepts is presented (Figure 1).

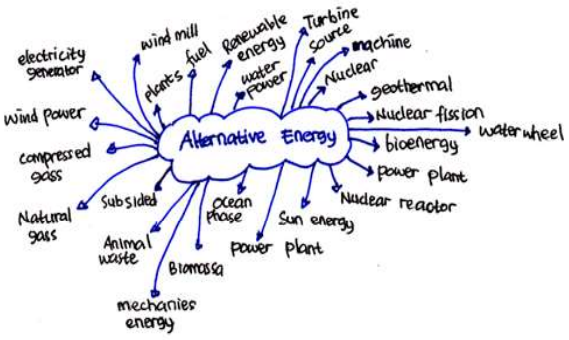

Figure 1. The Ability of Prospective Science Teacher in Determining Science Concepts

Participants describe scientific concept by first determining the theme. In Figure 1, the theme is alternative energy; there are 25 concepts that can be generated successfully by analyzing alternative energy. The broadness of generated concepts is quite deep since the participants are able to identify concepts to explain the theme broadly. Those concepts' broadness can be considered as evidence of the effectiveness of literature review, interview and observation that have been conducted. The results of the interview are prior to determine the theme and related concept that is first examined through a literature review. Students' understanding in the assessment shows that 85% of them are able to determine the scientific concepts properly.

The results of the literature review, interview and observation are used to identify the ap-

propriate local wisdom related with the pre-determined scientific concepts. Participants prepared the identification results in the form of mind maps (Figure 2).

Figure 2. The Ability of Prospective Science Teacher in Identifying Local Wisdom

Ethnic background of the participants did not cause any difference in determining the word related with local wisdom, since it is not restricted to a particular ethnic group. They identified local wisdom by formulating in one or two words. The full explanation of each word was arranged in. Students were able to determine 17 local wisdom words of alternative energy. Mind maps of science concept and local wisdom are used as the materials in integrating the the two domains in the form of mind maps. Students' mind map in linking science concepts with the local wisdom is presented in Figure 3.

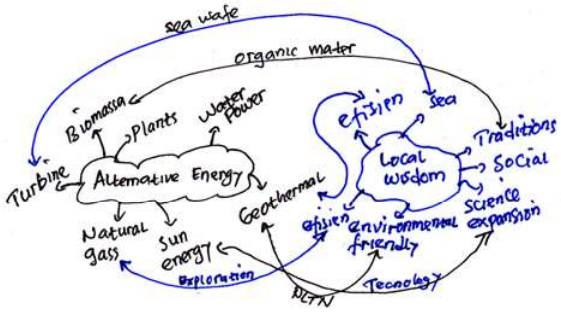

Figure 3. The Ability of Prospective Science Teacher in Linking Science with Local Wisdom

In Figure 3, there are 6 relationships between the two domains. The results of the overall analysis, the students were able to connect the two domains correctly between 4 to 8, the relationship is visualized in the form of a hyphen between the words of the two domains. Each connecting line annotated events for both words. Participants' idea is in broad category, while the depth is measured from the ability to apply the word "activity". Students were also able to connect the relevance in the form of a line between the science concepts and local wisdom. Participants were able to relate the concepts of science and local wisdom appropriately.

To gather deeper information, interview was done, they said that that science was completely related with local wisdom. According to participants, the cultures in society should be studied through scientific concepts. According to Meyer and Barbara (2011) science learning is included in the study of multicultural education because they are part of daily life and directly related with science. Culture provides a relevant review material in the teaching to achieve the formation of assumptions of the science facts explicitly. Integrating culture in learning science can encourage interaction between students and the community in diversity.

Analysis of the results of the literature review, interviews and observations are important in this study to confirm the direct linkage between the basic competence in science subject and local wisdom, in order to create the valid and unbiased mind maps. The results of the study of the relationship between the science concepts with local wisdom in the learning materials in junior high school are presented in Figure 3.

The participants gave wide concept in determining the appropriate form of local wisdom with scientific concepts from figure 3. The participants have diverse cultural backgrounds, thus affecting their learning style, but it results that they are able to integrate science and local knowledge well. According to Aikenhead & Jegede (1999) cultural background of students is brought into the classroom during the learning process, it plays an important role in the process of concept mastery.

Participants reveal the reason of doing the activities enthusiastically because of concerns of local culture that has noble values. Students have noticed the influence of foreign cultures that are not appropriate with the nation identity, it reveals some problems that occur in developing countries such as Indonesia. Learning in school should optimally provide and support to maintain and develop local wisdom.

Based on the results of the study, students as prospective science teacher believe to be able to apply science wisely to maintain and preserve the cultural. Reality shift in cultural values is resulting people forgetting local values. It needs more

Table 1. Result of the identification of local wisdom in accordance with the basic competencies of science subject in junior high school

Basic Competence	Local Wisdom
1. Understanding the procedure of classification of living things and inanimate objects as part of scientific work, and classifying various living things and inanimate objects based on the observed characteristics.	a. Naming herbs b. Ecotourism venture with plant name attractions c. Zoo and educational tours d. Farming systems
2. Understanding the characteristics of the substance, as well as physical and chemical changes in substances that can be used for everyday life.	a. Rocks and gravel serves as a filter for large materials, while sand can precipitate water's impurities. b. Taking *klenthik* oil or separating coconut oil from coconut milk c. The process of making salt
3. Describing the interaction between living things and their environment.	a. Using flower season to let the bees out of the nest by beekepeers b. Acceleration of organic fertilizer with the help of bacterial decomposition c. Distribution of forest for conservation and community
4. Describing the pollution and its impact on living organisms.	a. Cultivation of carbon absorber plants b. The hyacinth plant for breaking down the factory's waste water c. Aromatherapy plants
5. Describing the causes of global warming and its impact on the ecosystem	a. Greening with the productive plants and fruit b. Planting oxygen mass-producting plants in the garden c. Doing selective logging d. Tree planting as a requirement for getting married

massive efforts through education so the values of local wisdom can be preserved. Behavioralism states that culture is total way of life in everyday life.. Utilization of culture can foster self-awareness in the preservation of nature (Clayton and Gene, 2009). Society has developed the knowledge that has been passed as a means or original technology (indigenous ways) in order to utilize the natural resources for living.

Prospective science teacher in this study have been trained to develop intercultural understanding to appreciate their own culture, language and belief of others. Observations and interviews have actively engage students in learning cultural diversity, as a mean to recognize similarities and differences, create relationships with others and foster a sense of mutual respect. Research has revealed the success of prospective science teachers in transforming the two domains of knowledge. The original science society is transformed into scientific science knowledge as common procedure in the conceptualization and reconstruction of a new knowledge (Duit and Treagust, 2007). Various findings of the original scientific knowledge of society can be constructed into scientific knowledge to enrich the knowledge of

science through conceptualization. In the process of conceptualization we can apply naturalistic approach, ethnoscience, and constructivism (Snively and Corsiglia, 2000).

DISCUSSION

The results of the study confirms that Indonesia still maintain a close relationship between the culture and education. Science curriculum has been reformed to provide room for the cultural knowledge through basic competencies that explicitly relate it to everyday life. The fundamental problem is to link between science and culture. The lack of original content in textbooks causes obstacles to teachers in explaining the relationship of science and local wisdom leading to the failure of science learning. According to Kidman, *et al*. (2012) it is important to put local wisdom and knowledge in the science curriculum and develop reinforcement to students' sense of nationalism. Local knowledge in science can pedagogically contribute in understanding the native people that cannot be separated from the subject of scientific study.

Research has revealed the ability of to relate complex phenomena between science and culture. Learning using local wisdom approach is based on the recognition of culture as part of the fundamental (basic and essential) for education and communication as an expression of an idea and the development of knowledge. Revealling the local wisdom related to culture has proved to have a significant role in maintaining the culture. According to Stephens (2003), guidebook to integrate culture in the science curriculum must be able to provide a wide range of topics (e.g. medicinal plants, the use of local materials, equipment and technology, shelter and survival) that can be used to integrate the knowledge of culture and science.

If it is being studied in cognitive psychology, students' ability to integrate local knowledge with science cannot be separated from the conception of the individual's perception through the mind map. The ability of participants to uncover the relationship between science and local wisdom since the initial perception has been formed. The events that happened in the community, which has been processed related with the knowledge give the meaning to the sensory experience. Perception plays role in accepting, organizing, and translating or interpreting stimuli that have been organized,to influence the behavior and shape attitudes by using prior knowledge to collect and interpret the stimulus receiving by the sensing organs.

Therefore recommendations that can be formulated based on the results of the research are 1) inviting students to study science for a discussion of culture, 2) encouraging students' awareness of the contribution of culture in science through the study of literature, observation and interviews, and 3) promoting cultural diversity in the classroom.

CONCLUSION

This study contributes to determine how to integrate scientific concepts with local wisdom. Most students or 85% of them have been able to demonstrate the relationship between science and local knowledge. Literature review, observation and interview can be simultaneously applied to complementary information on local wisdom that has been identified in accordance with the science concept.

Education for prospective science teacher should emphasize on the skill to explore learning sources from physical and socio-cultural environment to enrich the understanding toward science concepts. The broad area and the diversity among the tribes in Indonesia can be put to be used as integral study of science. The use of local wisdom in learning also ascertains that learning science does not merely understand the concepts, but also strengthen Indonesia's identity with its various cultures. Changing the rich indigenous knowledge of the society, through this scientific research, works well in converting their indigenous knowledges into scientific knowledges which in turn to be appropriate to be used as learning material as modules and textbooks. Preparing prospective science teacher by strengthening the skill to explore learning resources from physical and sociocultural environment has become an alternative to achieve the purpose of learning science in Indonesia. The students are able to apply science wisely to maintain and preserve the culture and environment.

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