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Analysis of Creativity and Attitudes Caring The Environment of Junior High School Students: Study of Environmental Physics Learning Using Learning Modules

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Abstract

The natural and socio-cultural environment of the Wonosobo community has various potentials that can be explored and developed to support the science learning process. Pranotomongso is a form of culture used by farmers to cultivate nature. This study aims to determine the application of ethnoscience-based integrated science learning to foster environmental awareness and student creativity. This research is a quantitative study using the True Experimental method, with a Posttest Only Control Design, the sampling technique is random sampling. The instruments used for data collection were tests and questionnaires to measure creativity and environmental awareness. The data analysis technique used one-party t-test. The results showed that ethnoscience-based integrated science learning can foster environmental awareness and student creativity and can improve environmental care and student creativity in ethnoscience-based integrated science learning, in the medium category. This research is very useful in showing how science works in society, and it is more applicable.

Keywords: ethnoscience, integrated science, creativity, environmental care

INTRODUCTION

Indonesia is an archipelago country that has a diverse culture. Where there are noble values that must be preserved. One of the efforts to instill noble values is to make functions and goals in national learning. Integrating local potential in the learning process will develop the character of national cultural values in students (Fitria, 2018). The alternative way is to integrate the ethnoscience approach into the learning process. Ethnoscience is a cross-discipline of science that connects humans or their cultural cultures with science learning. Ethnoscience is a strategy for creating learning by integrating the indigenous culture of the community in the IPA learning process (Ahmad Khoiri, 2019) (Ahmad Khoiri, 2019). Local knowledge is obtained from life habits such as traditional culture, values, beliefs, and the real world (Lestari, 2016); (Jumini, 2016; Sudarmin & Sumarni, 2018).

The ethnoscience approach is the integration of culture as part of the science learning process (Sardjoyo, 2005). Integrated learning with the ethnoscience approach as the original community science can be packaged into a theme that is studied from various aspects (Mayasari, 2017). The *webbed* type is integrated learning that integrates subjects through a thematic approach (Shofwan, 2014). This type correlates basic competencies into a unified theme (Lam, Martin, Adler, and Sim, 2013)

The concept of basic science competencies at the secondary school level is related but inseparable and has different characteristics. Therefore, for the competence of students to be intact, these concepts are related to intersecting themes. The *webbed* type is the most appropriate type to combine. All concepts are connected to become a coherent bridge for active students in the learning process so that they understand the concept through real experiences.

Learning will be more meaningful if the themes taught are by the indigenous science of the local community (Malasari, 2019). Issues that are happening in the environment will be a special attraction for students. One of them is the impact of globalization and technological advances that have resulted in global warming. Global warming is an interesting theme because it is combined with the original science of the Dieng people, namely the shift of Pranotomongso. The Pranotomongso is used by Dieng farmers to start farming by reading the signs of nature, but the impact of globalization has resulted in the disappearance of the Pranotomongso.

In this study, researchers examined global warming with a webbed-type ethnoscience approach. Students can make direct observations

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so that it is easy to identify and explain the phenomenon of global warming that occurs naturally. With the hope that students can understand the concept as a whole so that their insights become broad and meaningful (Rusydi, 2018).

In modern education, the ability to think creatively is in the spotlight. Teachers must explore creative thinking skills that have not been mastered by Indonesian students. So far, efforts to develop creative thinking skills have not become the focus and attention of science educators. The results of research conducted by *Trend in International Mathematics and Science* in 2015 Indonesia are ranked 44 out of 49 participating countries with an average score of 397 which is below the TIMSS average score of 500 (Syamsul, 2018).

The initial abilities of students must be explored, especially creative thinking skills. Students have not been able to organize information to determine completion. Through the ability to think creatively students can find original and creative ideas, if there is a problem it can produce many solutions so it can be called inductive thinking (Siswanto, 2012).

Creative thinking skills need to be honed to arouse the creativity of students. Therefore, science learning should be integrated with the cultural environment of students to build curiosity about something in their environment. Science learning not only emphasizes memorized concepts but rather how students think creatively to find their learning material concepts so that their creativity grows. So learning that is not monotonous is needed so that students are more active and creative in the teaching and learning process so that learning is more meaningful.

As educators, the cultivation of skills education in students through the culture in the surrounding environment is very necessary, so that students can think scientifically about something around them. One solution is learning with an ethnoscience approach. Ethnoscience is a strategy for creating a learning environment and designing learning experiences that integrate culture as a learning process. Culture is all the way society lives and not just the way of life that developed in a group that is passed down from generation to generation. Along with the times and the flow of globalization, culture is displaced and less appreciated by students.

The natural and socio-cultural environment of the Wonosobo community has various potentials that can be explored and developed to support the science learning process. One of them is the Wonosobo farmers who are still closely related to nature. They recognize land cultivation in a traditional way that has been passed down from generation to generation. Farmers set the calendar for farming with Pranotomongso. It a calendar that regulates the working procedures of the farmers or the season setting (Anazifa, 2016).

Along with the development of science and technology that are increasingly advanced in agriculture, besides increasing agricultural production, it also harms the environment which has an impact on global warming. The occurrence of extreme climate change as if Pranotomongso no longer valid.

Pranotomongso is one of the cultures because the culture is the whole way of life of society and is not only about some of the life order which is considered higher and more desirable (Atmojo, 2012). The existence of *Pranotomongso* science principles as traditional science can be integrated into science learning on global warming material. How do we protect the environment to remain sustainable to avoid global warming? The importance of protecting the environment does not seem to be underestimated. Based on data from the Central Bureau of Statistics in 2012, the results of a survey on environmental care behavior conducted in 33 provinces show that environmental care behavior in Indonesia is still low with a score of 0.57 from the range 1-10 (Wicaksono, 2018). So, it is necessary to foster a caring attitude towards the environment that is integrated with science learning through an ethnoscience approach. It is hoped that this ethnoscience approach can foster environmental care for students to prevent global warming and foster creativity.

Based on the problems, this study aims to integrate and materialize global warming with a webbed-type ethnoscience approach and the implementation of integrated science learning with an ethnoscience approach with the theme of global warming. This learning will bring students closer to the real context of daily life, stimulate creativity and imagination, and foster an environmental care attitude so that they will be better able to develop students' scientific attitudes and student entrepreneurial characters (Sri Jumini & Sutikno, 2019). Learning will be more meaningful not only for students but also for solving global, natural, and socio-economic problems.

METHOD

The study uses the approach quantitative using methods True Experimental design Posttest Only Control Design, Mechanical sampling random sampling. The data instrument for environmental care and creativity of students used a questionnaire sheet. The questionnaire used was a closed questionnaire. The

questionnaire sheet for environmental care uses a Likert scale and the creativity questionnaire uses multiple choices filled out by students after the learning process is carried out, for data collection the studens' creativity was measured by a creative thinking ability test in the form of description questions. Question descriptions are distributed before the learning process is carried out (pretest) and after the learning process (posttest). The results of the pretest and posttest are used to determine students' creative thinking abilities with indicators. The data analysis technique uses the t-test, to see whether there is a growing scientific attitude and creativity.

$$t_{count} = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}} \quad (1)$$

Gain test to determine the growth of creative thinking in integrated science learning based on ethnoscience. Tests conducted using the Hake factor calculation technique (Fathur, 2012).

$$< g >= \frac{s_{post}-s_{pre}}{100-s_{post}} \quad (2)$$

RESULT AND DISCUSSION

In *webbed* type learning, basic competencies are compiled into a unified theme (Lindahl & Lundin, 2016; Lutfiyah, 2013; Parmin et al., 2017). The choice of the theme "Global Warming". Based on motivation is an important concern in this type of learning. The integrated pattern used is a spider web (webbed) where interest is the center of each integrated basic competency.

The science learning theme of global warming webbed type with the ethnoscience approach is implemented in Class VII Middle School (SMP).

Table 1. Basic competencies and indicators used in the theme of global warming based on the 2013 curriculum at the junior high school level (Widodo, 2017)

Basic Competency		Indicators	
3.4	Analyzing the concepts of temperature, expansion, heat, and heat transfer and their application in everyday life	1.	Explain the radiative heat transfer from sunlight energy
		3.	Describe the process of solar radiation
		3.	Explain the meaning of the greenhouse effect
		4.	To analyze the mechanism of the greenhouse effect
3.7	Analyzing the interactions between living things and their environment	1.	Analyzing the greenhouse effect on agricultural activities
3.8	Analyzing environmental pollution and its impact on living things	1.	Analyzing the relationship between air and soil pollution and the greenhouse effect
		2.	Analyzing the relationship between the greenhouse effect due to pollution to the ozone layer and global warming
3.9	Analyzing climate change and its impacts on ecosystems	1.	Describe climate change
		2.	Analyze the relationship between climate change and global warming
3.11	Analyze the solar system, the rotation, revolution of the earth and the moon and their impact on life on earth	1.	Describe the effects of rotation, revolution, of the moon and the earth to changes in seasons

The basic competence in science teaching based ethnoscience type *webbed* theme Global Warning shown in Table 1. The basic competencies took regarding global warming. Global warming cannot be separated from the sun. The existence of the sun is vital to life on earth. The sun's thermal energy is radiated to outer space and a small extent to the earth. Solar

energy radiation penetrates the earth's atmosphere. The atmosphere functions as a protector of the earth by preventing radiation from excess solar energy. Energy will be absorbed by the earth and partially reflected into the atmosphere. By Karen, the average temperature of the earth's surface is higher when there is no atmosphere. The greenhouse effect has the same function as the Earth's atmosphere.

In the twentieth century, the greenhouse effect was a topic of conversation. A significant increase in the average temperature of the Earth's atmosphere has been felt. The increasing number of greenhouse gases in the atmosphere is a contributing factor. Also, air pollution is increasing due to the use of CFC gas-producing goods. Increased CFC concentrations have an impact on the perforation of the ozone layer so that there is direct contact between harmful solar radiation and the earth's surface.

Error interacting with nature resulting in a balanced ecosystem The era of technological modernization that is developing cannot be denied a negative impact that produces greenhouse gases. As a result of human activity, the earth's atmosphere changes. Increasing greenhouse gases have an impact on global warming.

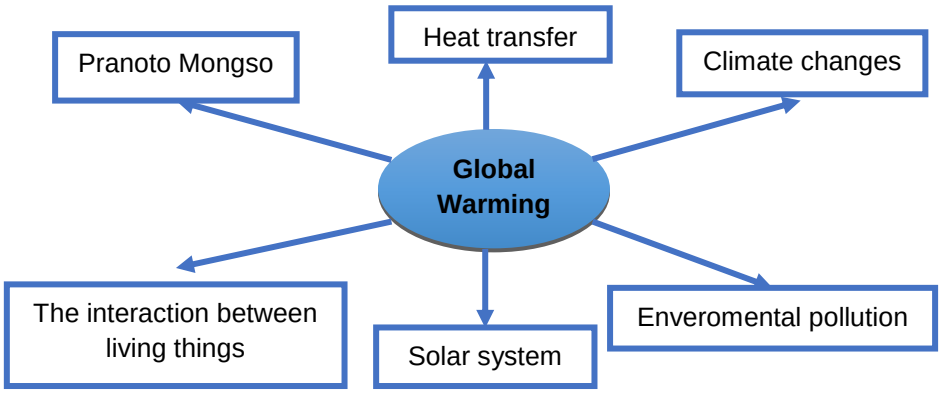

Figure 1. Integrated IPA *Webbed* Type

Indonesia is a tropical area that is passed by the equator so that it experiences two seasons, namely the rainy and dry seasons. Seasonal changes occur because of the earth's revolution which affects the annual apparent motion of the sun.

In the last few decades, there has been erratic climate change on earth. Currently, Indonesia is experiencing climate aberration. Problems that humans cannot avoid are caused by themselves. Farmers can not predict prolonged drought and rainfall using the Pranotomongso calendar. Natural conditions are increasingly unbalanced, climate can no longer be predicted through natural signs (Anazifa, 2016; Nurdin & Ng, 2013; Parmin et al., 2017; Parmin & Fibriana, 2019).

Noble culture is now abandoned. Humans choose a modern lifestyle that is not friendly to nature. Pollution occurs everywhere and as a result, global warming is a matter that cannot be avoided. Apart from causing seasonal changes, modernity also eliminates a cultural wealth that has guided Javanese farmers for so long in farming. The rays of Pranotomongso are due to modern agricultural systems that are not environmentally friendly.

The shift in Pranotomongso due to the impact of global warming in Dieng is integrated into the learning process so that students' insights become comprehensive and broad about local culture. The basic competencies taken are correlated with global warming so that they form a spider web with the theme of global warming centers.

The use of integrated learning that is integrated into everyday life encourages students to think broadly to build the conceptual relationships that are taught. Furthermore, students are motivated in the learning process because learning feels meaningful so that it is implemented in everyday life. In science learning, students are required to understand the natural surroundings through scientific (scientific) methods. The scientific approach steps include observing, questioning, experimenting, associating, and networking (Sufairoh, 2016). The five processes are implemented in learning

which are described as follows: 1) observing, students are directly involved in observing the facts faced in life. This process includes observing, seeking, asking, reading, seeing and hearing. 2) questioning, this process is so that students think critically through group discussions by allowing students to propose ideas they have. 3) Experiment, the students' curiosity increases after going through the stages of planning, data collection, analysis, and concluding. 4) associating, developing students' scientific thinking skills and attitudes, 5) networking, writing down what is found, and explaining or informing. The expected result in scientific learning is an increase in soft skills and hard skills which cover three aspects of cognitive, affective, and psychomotor (Rosana, 2013).

Ethnoscience-based integrated science learning is applied to class VII SMPN 1 Sukoharjo. Samples were tested for the initial ability similarity before being given treatment. Data description of the similarity of students' initial abilities in Table 2.

Table 2. Initial ability equality data

Class	∑		Min	Max	s^2
Experiment	1292	43.06	28	53	27.92
Control	1304	43.46	30	56	41.58

Initial ability testing used the *Liliefors* test *for* the experimental class 0.0858 <0.1610 and the control class 0.0918 <0.1610. Both groups were normally distributed. The homogeneity test of the two classes shows that the sample comes from a homogeneous population F count <F table (1.488 <1.85). Test two parties to test the similarity of prior knowledge gained Price t table > t count (5%; 2.000> 0.263).

Data that pass the preliminary test are said to be worthy of treatment. In the research process, the treatment was given to the experimental class using integrated science learning based on ethnoscience where students were given a learning guide book in the form of a module. The module used is the Integrated Science Module Based on Ethnoscience with the theme of Global Warming associated with Pranotomongso. Control class with conventional learning.

Figure 2. Ethnoscience-Based Integrated Science Learning Module

The content contained in the module contains learning activities that aim to foster the environmental care and creativity of students.

Table 3. Module Contents

Activity 1	Self analyzes the "Green House Effect" experiment on video presented by the teacher.
Activity 2	"Impact of Global Warming" Identify the causes of global warming, the impact of global warming and analyze the relationship between the temperature changes and changes in seawater changes with climate change.
Activity 3	The project task is in the form of "Let's Make a Poster" by choosing several themes, namely my earth's past, my earth now, my earth's future if global warming occurs, and the role of youth in protecting the earth.

The application of ethnoscience-based integrated science learning in the learning process at SMP Negeri 1 Sukoharjo is something new so that students are more enthusiastic about learning science. The environment as a learning resource facilitates the learning process because students already know and have insight first so that learning becomes meaningful (Susanti, 2013). This was supported by Ruswandi that utilizing the environment in learning made the teaching and learning process meaningful because students were faced with actual circumstances or events naturally (Istialina, 2016), (Baranov et al., 2019; Daniel Tan & Kim, 2012).

Based on the results of the data analysis, ethnoscience-based integrated science learning shows better results than conventional learning. From the research results, after the treatment was given to the experimental class using ethnoscience-based integrated science

learning, the results were better than the control class. This is based on the acquisition of the average percentage score of the environmental care attitude questionnaire, the creativity questionnaire, and the *posttest* value of creative thinking.

The results showed that the average percentage of the questionnaire on environmental care was 87% for the experimental class and 84% for the control class. The results of the questionnaire recapitulation of students' environmental care attitudes after treatment.

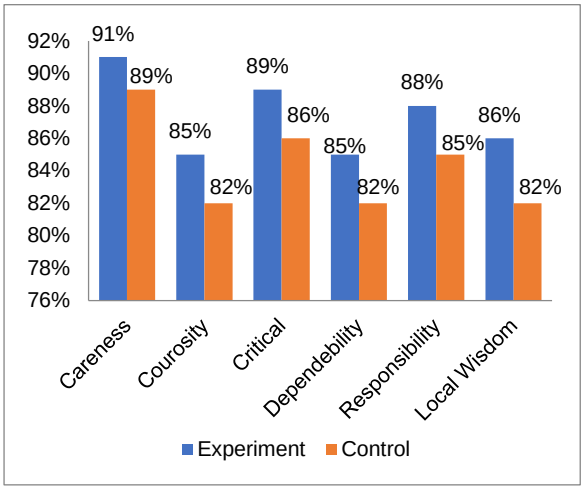

Figure 3. Questionnaire results for environmental care

The percentage of each indicator in the experimental class is higher than the control class. Ethnoscience learning-based integrated IPA able to cultivate an attitude of a caring environment of the learners as proposed Sya'ban that learning associated with the environment has benefits for individuals to form students to recognize, manage and maintain both the environment and prudent (Balqis, 2018) environmentally conscious attitude indicator *awareness* is the indicator with the highest percentage is 91% in the experimental class were classified as very good.

The *Careless* indicator that grows in the environmental care attitude of students is supported by Widodo that environmental *Careness is* formed through environmental learning (Adawiyah, 2018; Khoiri et al., 2020). Caring and having a culture of the environment can be considered as attention to facts and self-behavior with certain consequences to protect the environment around us (Lambrechts et al., 2019; Murniawaty, 2019; Rini, 2017). If everyone cares for the environment, the environment will be sustainable and all of that will be enjoyed by humans again. Therefore, concern for the environment and preserving the environment is very important for students starting by doing small things that can contribute to the environment (Herman, 2016; Mukani, 2017).

Ethnoscience-based integrated science learning fosters the creativity of students. This can be seen from the results of the creativity questionnaire with an average percentage of the experimental class of 75.75% while the control class is 69.75%. The results of the recapitulation of students' creativity questionnaire after treatment.

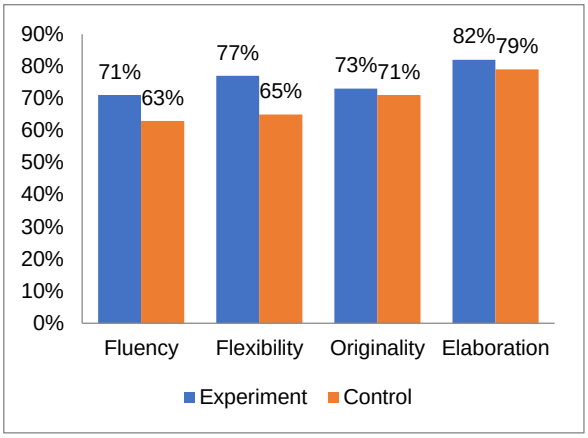

Figure 4. Results of the Creativity Questionnaire

The percentage value of each indicator in the experimental class is higher than the control class. Integrated learning can provoke the creative and active thinking of students. Students with high creativity can solve problems in their learning so that they have better achievements than students with low creativity (Jumini, 2016; Khoiri & Sunarno, 2019). P Participants learners confronted with problems in daily life, close to his world, and facilitate learners to recognize, accept, absorb and Understand the linkages and relationships between concepts, knowledge, values, or actions contained in the Basic Competencies and Indicators. Thus integrated learning leads to better learning abilities of students, both in terms of intelligence and creativity. This was reinforced by Graham Wallas that creativity through four stages,

namely *preparation, incubation,* illumination, and verification (Rusdi, 2017), the coverage of four stages in integrated learning can foster the creativity of students in the experimental class with the highest percentage of indicators, namely elaboration of 82%. which is good. Students can develop ideas and detailed problems. According to Munandar, elaboration in thinking is the ability to enrich, develop, add to an idea, detail details, and expand an idea (Ibrahim & Irawan, 2015; Susanti et al., 2020).

Through integrated science learning based on ethnoscience, the knowledge obtained is more meaningful because it is beneficial for the environment of everyday life. Think of creative learners' gain increases with a score of 0, 34 category being. Creative thinking can also be seen as a process when someone comes up with new ideas. New ideas are a combination of previous ideas that have never been realized (Fatmawati, 2011). This is by previous research that integrated learning improves students' creative thinking. (Khoiri & Sunarno, 2019; Şener et al., 2015)

The results of the analysis regarding the differences in ethnoscience-based integrated science learning on students' creative thinking used the *posttest* mean value of creative thinking students in the experimental class 60, 65, and the control class 56.42. The results were obtained by the calculation of the t-test hypothesis test. The test using the t-test formula obtained a value of t count 2, 06 with a T-table value of 1.684 at a relative error of 5%. T count > T table (2 , 06 > 1.684), then H o rejected and H 1 accepted. So it can be concluded that "there is a difference between ethnoscience-based integrated science learning and conventional learning to foster environmental care and creativity".

Integrated science learning is the concept of learning science with more "natural" situations and real-world situations for students, and encourages students to make connections between branches of science and between their knowledge (Kesipudin, 2008). With integrated science learning that is associated with the original culture of the community, it will foster a caring attitude for students to the surrounding environment. Integrated learning science ethnoscience able to cultivate an attitude of care for the environment, especially on indicators *Careness* the percentage of high achievement.

Various activities applied to ethnoscience-based integrated science learning require students to generate ideas, find related relationships, create and carry out imagination and have many perspectives on something so that they can foster their creativity. The results of the data analysis showed that each indicator of the creativity aspect of the experimental class students was higher than the control class, especially the ability to elaborate because ethnoscience-based integrated learning provided opportunities for students to develop their ideas and creativity. The higher growth in the experimental class showed that through ethnoscience-based integrated science learning, it was able to increase students' creativity and environmental care attitude compared to the control class. Learning the contextual control class that focuses pad is a matter of learning style is different from the broader experimental class associated with the original scientific community. These results are consistent with previous research that ethnoscience-based integrated learning can increase student creativity (Pamungkas et al., 2017).

CONCLUSION

There is a growing attitude of environmental care and student creativity in ethnoscience-based integrated science learning. Based on the research results, the elaboration indicators on the aspect of creativity are very good. The magnitude of the elaboration aspect is caused by activities that require students to develop ideas and details. In the aspect of environmental awareness, there is good growth in the Careless Indicator. A caring attitude grows through learning related to problems in students' daily lives. So that students understand how important it is to protect the environment.

There is a difference between integrated science learning based on ethnoscience and conventional learning to foster environmental awareness and creativity based on the results of statistical tests and discussion. Ethnoscience-

based integrated learning is different from conventional learning because learning relates learning material to the indigenous culture that students usually encounter every day and encourages students to be active in the learning process. Ideas develop so creativity grows.

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