



Research Article

Science Process of Environmental Conservation: A Cross National Study of Thai and Indonesian Pre-service Science Teachers

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Received: 5 September 2018 **Accepted:** 8 December 2018

The study aimed to preliminary study on science process of science teacher candidates, the environmental conservation based on local wisdom is investigated. Participants were 95 science teacher candidates from Thailand and 71 from Indonesia. Data were collected through scientific literacy questionnaire on Baduy's society. Percentage, mean, standard deviation, and non-parametric statistics were used. Findings showed that Thai science teacher candidates had mean score higher than those Indonesian science teacher candidates at 0.05 level of statistics. Science process on environmental conservation need to be implemented in teacher students due to it can make them to meet real science.

Keywords:

science process, environmental conservation, local wisdom, Baduy's society, teacher student

To cite this article:

El Islami, R.A.Z., Nuangchalerm, P., & Sjaifuddin, S. (2018). Science process of environmental conservation: a cross national study of Thai and Indonesian pre-service science teachers. *Journal for the Education of Gifted Young Scientists*, 6(4), 36-71. DOI: <http://dx.doi.org/10.17478/JEGYS.2018.84>

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Introduction

Science is a vital tool for modern life based on the head and heart of working with nature. However, hands can make science to meet new frontiers of knowledge and push science up to new standing in society. Science cannot be separated from our daily life because science is life. However, science is still need to be proved by scientific method or reliable procedures, making possibility to its nature by acceptable explanation. These are nature of science- scientific worldviews, scientific inquiries, and scientific enterprises (AAAS, 1990; Nuangchalerm, 2009). The nature of science associates with how people know and understand about science and also employ science to solve problem in the daily life. Nature of science is basic knowledge and understanding to help people in literately from experiments to society.

Accordingly, nature of science and literacy help people make a better live together, aware to use science by conscious mind, sustain nature and resources, and conserve environment. Science help citizens involved in participatory conservation and decision making, managing natural resources, and sustaining diversity of environments. Science also help people meet their science and/or public input and engagement needs, and make alternative choices or informed decisions in chain effects in following (McKinley *et.al.*, 2017). The environmental conservation should be implemented in the school for value clarification and bridge the gap between demand and supply of limited natural resources. The process of education and science lead students to aware, change behavior, and make citizens science as well.

Teacher candidates is a key element to change and improve quality of education due to classroom need effective instruction, meet the standards and requirements of profession (Prachagool *et.al.*, 2016). Science process is one of four domains of scientific literacy. Scientific literacy divided to four domains, such as content of science, context of science, science process, and science attitude. Nuangchalerm and El Islami (2018a) compared context of science between Thai and Indonesian novice science teacher students, the conclusion indicated that context of science Thai novice science teacher students had better than Indonesian science teacher students,

but there is no significantly differences by statistical testing. In addition, Nuangchalerm and El Islami (2018b) compared content of science between Thai and Indonesian novice science teacher students, it can be concluded that content of science Indonesian novice science teacher students had slightly better than Thai science teacher students, but there is no significantly differences. From two research by Nuangchalerm and El Islami we can see that Thai and Indonesian novice science teacher students have their own advantedges in scientific literacy. This study aims to investigate science process of environmental conservation, it can help us to understand how pre-service teacher perceived and express their value to environmental conservation from case study of Baduy's society. Thai and Indonesian pre-service teachers are participants to preliminary study. If pre-service teachers aware in environmental conservation, we can predict some phenomena of education in the future because they are change agent in classroom level.

Method

During January-February 2018, survey was employed for the study by investigating science teacher candidates from Indonesia and Thailand. Science process on environmental conservation was used for asking them about Baduy's society and way of life to sustain their environment. Data were collected and analyzed through 71 Indonesian and 95 Thai teacher candidates. They were asked with 3 questionnaires, which adopted from El Islami, *et.al.* (2016). Science process instrument can be considered in three competencies on identifying scientific issues; explaining phenomena scientifically; and using scientific evidence (OECD, 2007). The instrument use the contexts on Baduy's house position; Baduy habits in daily activities, and Baduy's house form. These contexts are emerged from local wisdom of Baduy's society on environmental concervation theme.

The local wisdom of Baduy's society on environmental conservation theme, was an example of context of science for environmental concerns. The questionnaires were used and then they answered. Data were carefully checked the completeness and filled it into the statistical testing program. The study used descriptive statistics and Man-Whitney U test employed.

Results

The study measured three competencies on identifying scientific issues; explaining phenomena scientifically; and using scientific evidence. Students' science process that is known based on the results of multiple choice tests, adopted from El Islami, *et.al.* (2016) are investigated. Based on our study, questionnaire conducted at one of the state university in Thailand and one of the state university in Indonesia. The science process of Thai and Indonesian science teacher candidates are shown in Table 1.

Table 1.

Science Process of Thai and Indonesian Science Teacher Students

Science Process	Thai (Mean) (n=95)	Indonesian (Mean) (n=71)
Identifying scientific issues	47	68
Explaining phenomena scientifically	52	32
Using scientific evidence	59	21
<i>Total Mean Score</i>	<i>53</i>	<i>40</i>

The science process of Thai science teacher candidates had better than the science process of Indonesian teacher candidates. There is a .05 level of statistical significantly differences. We can see the variation of mean science process between Indonesian and Thai science teacher candidates, Table 1 showed that Indonesian science teacher candidates had mean score higher than those Thai science teacher candidates on the competencies in identifying scientific issues. But, Thai science teacher candidates had higher score than Indonesian science teacher candidates on explaining phenomena scientifically and using scientific evidences.

To make sure, testing by statistics in each science process is conducted. There is differently tested. The Kolmogorv-Smirnov test showed that science process of Thai and Indonesian science teacher candidates are not normal. Lavene test used and it showed homogeneous. So, to know the difference of Indonesian and Thai Science teacher candidates, Man-Whitney U test is used (Table 2).

Table 2.*Science Process between Indonesian and Thai Science Teacher Candidates*

Aspect	Thai (Mean)	Indonesian (Mean)	Mann-Whitney Test (α)
Science process	53	40	0.015 < 0.05 (significant)

Table 2, data presented that science process of Thai science teacher candidates had better than Indonesian science teacher candidates. There is statistical differently significance (Sig. 0.015 < 0.05). This finding can be discussed to science process which Indonesian and Thai students play their roles in science education.

Discussion

The Indonesian science teacher candidates had mean score higher than those Thai science teacher candidates on the competencies in identifying scientific issues, indicates that Indonesian science teacher candidates had ability in recognising issues. It also can be explored scientifically and ability in recognising the key features of a scientific investigation better than Thai science teacher students (OECD, 2007). Indonesia has a new curriculum in 2013 or K-13. In K-13 teachers use the scientific approach in learning especially in science learning. The regulation of ministry of education year 2016 describes the scientific approach as observing, questioning, experimenting, associating and communicating. Learning process by scientific approach in Indonesia's school with K-13 make the learning process oriented to recognise scientific issues, it can be explored scientifically and recognise the key features of a scientific investigation (Republic of Indonesia, 2016). Indonesian students asked to observe the phenomena, then Indonesian students asked the questions to the phenomena after they observe the phenomena, then Indonesian students asked to give the initial answer for their questions and do the experiment for answering the questions, then the Indonesian students asked to associate the experiment result with the initial answer, after it Indonesian students asked to communicate the associate of the experiment result with the initial answer. This learning process will give the ability of Indonesian science teacher students to get the ability of science process especially in identifying scientific issues.

In the context of Thai, they had higher score than those Indonesian, but their skills to identify scientific issues need to be improved by process of education. Thai science education emphasizes the scientific knowledge, the nature of science, and the relationship between science technology and society, but science process and related issues need more studied (Yuenyong and Narjaikaew, 2009). Identifying issues need to implement in science classroom. Although the school science curriculum and instruction features scientific literacy as well. Thai science education research, articles, national tests, and teaching and learning emphasize scientific achievement with little concern about science. However, some attempts at developing scientific literacy have been made recently. Some school science curricula and teaching and learning has tried to organize science learning emphasizing the relationship between science, technology and society based on the Thai context. Yuenyong and Narjaikaew (2009), concluded that Thai science education will give the ability of Thai science teacher candidates in science process especially in identifying scientific issues, but the Indonesian science teacher candidates better than Thai science teacher candidates.

The Thai science teacher candidates had score higher than Indonesian science teacher candidates on the competencies in explaining phenomena scientifically and in using the scientific evidences. It indicates that Thai science teacher candidates had better score than Indonesian science teacher candidates in applying knowledge of science in a given situation to describe or interpret phenomena scientifically and predict changes and in interpreting the evidence to draw conclusions. They identify the assumptions, evidence and reasoning that underpin them and to reflect on curriculum and teaching implications (OECD, 2007).

Indonesia and Thailand have developed the science education curricula oriented to science process. But in Indonesia the implementing of curricula namely K-13 not good yet. Alawiyah (2016) explain that obstacles experienced by teachers in one of the school is the many aspects that must be assessed in the assessment of K-3, the assessment is done simultaneously with the learning process, thus making the learning process becomes less effective and the teachers feel burdened because they

have to add up the value of each student as a whole and then describe the value obtained per subject. According to the facts, we can conclude that Thai science teacher candidates better than Indonesian science teacher candidates on the two competencies are explaining phenomena scientifically and using the scientific evidences.

Indonesia and Thailand is a part of Association of South East Asia Nations (ASEAN). Both of this nations are development country. The education system of Indonesia and Thailand are not so different in the philosophy and nature of science education, like Indonesia and Thailand use the context for education development. But curriculum implementation in science of two countries are so different. According to the previous study such as PISA 2000-2015, scientific literacy of Indonesian students never had better score than Thai students (OECD, 2001; 2004; 2007; 2010; 2014; 2016). So, Indonesia has to develop curriculum and instructional strategies as well as scientific literacy. Science process can improve to be better by learning activities, let students have experiences, allow students to meet nature of science, and engage students to learn science. The mean score of science process of two countries are not yet give the best score, it is give the suggestions to both of countries to develop science teacher candidates in science process and nature of science education.

Conclusion

The science process of Thai science teacher candidates had better than Indonesian science teacher candidates. The curriculum and instruction should promote them to have science process, scientific literacy, and nature of science. The mean score is not make science educators satisfy, the process of teaching and learning need to be more design and invite to teacher preparation program.

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