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The Effectiveness of Science and Society (SCE552) Course in Instilling Environmental Knowledge and Awareness to Pre-Service Science Teachers in Faculty of Education, UiTM

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Abstract: Teachers are vital agent of a nation in order to instil and enhance student's environmental knowledge and awareness. To produce teachers who are capable to carry out such role, teacher training institutions should provide mechanisms for the future teachers to learn and improve their content knowledge and related skills. This is to ensure effective delivery of environmental knowledge and inculcation of environmental awareness. This study was conducted mainly to investigate the Effectiveness of the Science and Society (SCE552) course in instilling the environmental knowledge and awareness to pre-service science teachers by examining the Faculty of Education UiTM's pre-service science teacher's level of knowledge and awareness of the environment. The study employed qualitative research design which semi-structured interviews, observation and document analysis were carried out for data collection purposes. Three groups of students were involved in the observation while 21 pre-service science teachers from the three groups were randomly selected for interviews. The study found that the SCE552 course is effective in instilling the environmental knowledge and awareness among the pre-service science teachers as they reflected their sound understanding of the environmental terms, issues and also their high level of awareness. However, the results suggest further improvement need to be done on the course in order to help the pre-service teachers to translate the knowledge and awareness into practice. The study found that the active learning approach that has been practiced by the instructor of the course as well as the nature of the course that requires the pre-service teachers to look up for more information for presentation and class discussion are among the factors that contribute to the effectiveness of the course. The study urges teacher training institutions to produce more prospective teachers with sound environmental knowledge, improve the effectiveness of the environmental-related courses as well as to adapt active learning approach in order to enhance future teacher's environmental knowledge and awareness.

Key words: Pre-service science teachers, environmental knowledge, environmental awareness, active learning approach, knowledge and awareness

INTRODUCTION

In-line with Malaysia's aim to be a developed nation by 2020, education in Malaysia should also be upgraded not only to cater to the nation's needs for professional manpower who are crucial for the advancement of Malaysia but also to overcome over raising effects of modernization and rapid development that threaten the well-being of our environment and society. There are many programs conducted by various organizations and institutions to instill the environmental awareness into the society due to the growing numbers of environmental problems. Nonetheless, the number of problems continuously increased and it indicates the program's ineffectiveness on instilling the environmental awareness. Thus, the environmental stewardship should be instilled from basic which is at schools as studies found that education should be the best platform for the purpose (Salleh *et al*., 2015; Roczen *et al*., 2014). A study of Roczen *et al*. (2014) stated that environmental attitude could be promoted by having at least a small degree of environmental knowledge. Besides that there is a positive correlation indicating that positive environmental attitude does motivate human to learn more on the environmental system or vice versa. As environmental knowledge is embedded in the school subjects in Malaysia; science

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subject should be one of the mediums to enhance society's knowledge and awareness of our environment for sustainable future. Thus, it is the teacher's responsibility to impart the environmental knowledge as well as inculcate the awareness to the students during the teaching and learning process. To influence the student's attitude on the environment, hence, it is fundamental for the teachers to have knowledge on the environment and the right attitude towards the environment (Tuncer *et al*., 2009).

One of the imperative reasons for the pre-service science teachers to prepare themselves as a part of the school system is to be equipped with the knowledge on the environment and the awareness of the environmental issues. In realizing this, Faculty of Education, Universiti Teknologi MARA (UiTM) offers science and Society, SCE552 course to integrate STSE and incorporate the environmental knowledge to the pre-service science teachers. It is a course which serves as an outlook on science education that emphasizes the teaching of scientific and technological developments in their cultural, economic, social and political contexts. The SCE552 course is compulsory for the science education students (pre-service teachers) in the first semester of their undergraduate studies in UiTM. Through discussions and activities in class, this course prepares the pre-service science teachers to be well-equipped with STSE issues and instils environmental awareness. Throughout the course, students are encouraged to engage in issues pertaining to the impacts of science on everyday life and make responsible decisions on how to address such issues. Students learn in a meaningful way about current social interest and the big ideas in science such as nuclear warfare, environmental pollutions and preventions, natural disasters and sustainable development to name a few. The group projects required students to work on each issue highlighting the science content of it. The issues within specific topic are identified by the students themselves with the guidance from the instructor. The class activities involved presentations, discussions and hands-on activities which mostly embraced students-centred approach while the instructor plays the role as a facilitator (Desta *et al*., 2009).

Upon the completion of SCE552, students should be able to demonstrate the variety of real world issues and grounding scientific knowledge in such issues that might include the impact on society. Besides, they will be able to formulate critical understanding of the interface between science, society, technology and environment. Moreover, this course aims to develop the student's self-determination and confidence to make informed-decisions and to take responsible action to address issues arising from the impact of science on their daily lives. They should be able to construct a project via student-led science inquiry or technology design and share it with society. Last but not least, they should be able to analyse the negative and positive aspects of the science and technology nature and relationships with society and environment. The course was introduced in 2006 and until now, it is still being offered to the pre-service science teachers in Faculty of Education, UiTM. However, there is no specific study conducted to find out on the effectiveness of the course especially to enhance the pre-service science teacher's knowledge and awareness on environment. Correspondingly, this study aims to: identify the level of environmental knowledge and awareness of the pre-service science teachers in Faculty of Education, UiTM to find out the effectiveness of science and society (SCE552) course in instilling the environmental knowledge and awareness on the pre-service science teachers in the Faculty of Education, UiTM.

MATERIALS AND METHODS

This study employed a qualitative research approach whereby case study is chosen as the design of the study. For the case study of SCE552 course, data were gathered from three different events which were classroom observations semi-structured interviews and document analysis. Overall, there were 3 groups of students involved in the study with the total number of students from the three groups was sixty five. The observations were made during the selected SCE552 classes which focused on the following aspects: interest in learning the topics responses towards the stimulus/questions posed emotions towards the environmental topics/issues highlighted. For the interview, seven students from each group were conveniently selected and the total number of students involved was twenty one. The interviews were carried out to affirm the observation made during the class. The semi-structured interviews were carried out in groups and each session in average, lasted between 60-80 min. A set of validated interview questions was prepared by the researchers prior conducting the interview. A semi-structured interview was used as it allows the researchers to probe whenever necessary depending on the respond given by the samples on the pre-determined questions for them to provide in-depth explanation or further clarifications. Among the questions asked include basic questions related to environment which include the definitions of environment, ecosystem, climate change and global warming. Besides that, the current environmental issues in Malaysia and world wide were asked in details, including the consequences of such issues and the cause of the problems. The interviews were

transcribed and the responses given were analyzed and subsequently grouped into the relevant themes and patterns. Additionally, document analysis was carried out to support the findings from both the observation and interview.

RESULTS AND DISCUSSION

Level of pre-service science teacher's environmental knowledge and awareness: Environment is one of the topics that commonly included in Science, Technology, Society and Environment Education (STSE). In SCE552 course itself, there are several topics related to environment. In order for the researchers to determine the level of knowledge and awareness of the pre-service science teachers related to the environment, data which gathered from the observation in selected SCE552 classes, semi-structured interviews and document analysis had been used to make a conclusive judgment on that matter. Basic questions on environment were asked and most of them were able to give correct responses. They also managed to list down the consequences of the inquired environmental activities and environmental problems except for a few misconceptions noted in their responses. When they were asked to define about environment for instance, a few definitions of environment were given by the respondents. Most of the respondents managed to answer this question correctly, which they mostly used the terms "surroundings" and "living and non-living". A misconception was noticed when a respondent used the sentence "community that included the surrounding" to describe environment. Researchers believed that either the respondent really had a misconception out of confusion or the respondent was meant to say "the surrounding that includes the community" which was the reversal of the sentence used may be due to absent-mindedness or difficulty in using the right term to describe scientific phenomena or terms. Environment is defined as an outer physical and biological system in which human and other organisms live with many interacting components (Kanagasabai, 2010). However, there were a few respondents defined the term "environment" by using layman's terms such as a space outside human's body and a medium for social activity. Possibly, these respondents were trying to define the term according to their own understanding and they could not relate to the study carried out. A Biology pre-service teacher for example, defined environment as karma which was totally out of context. The researchers assumed that the respondent was trying to talk about the consequences that the society might have to face if they have negative environmental attitude. The following excerpts support the above mentioned statements:

> "…A space outside our body and a medium for social activity" (Respondent K)
> "…Environment is one of the community that included all the surrounding…" (Respondent H)
> "… Environment is like karma. If you do something bad, either intentionally or unintentionally, you must ready to face the consequences…" (Respondent G)

Besides that, the analysis of respondent's answers on the definition of ecosystem shows all of the respondents included the term "interaction" and "relation" in defining ecosystem. Compared to the term 'environment', ecosystem is more scientific word in nature. Hence, no misinterpretation occurred and the respondents answered accordingly. The researchers noted that, the pre-service science teachers were also aware of the recent environmental issue occurring in Malaysia and worldwide as they voiced out their unhappiness with the issues. The issues that they pointed out as the most recent environmental issues in Malaysia include haze, floods and pollutions. All of the respondents listed down the health and environment as the main concern when it comes to the effect of these environmental issues. However, the respondents did not explain in details the effects of haze to human. They only managed to provide general answers such as respiratory problems and difficulties in breathing. Only one respondent was able to scientifically name a disease as an effect of haze which is Chronic Obstructive Pulmonary Disease (COPD). Besides the major issue in Malaysia, the respondents were able to explain in details on the most worrying environmental issue worldwide which is global warming.

The analysis of data in this study shows that the respondent's responses to the effect of global warming were different from one course to another. Most of the Biology pre-service teachers listed the rise of sea level and limitations to outdoor activities as the main impacts of global warming, while Physics pre-service teachers focused on the raise of global temperature. There were Chemistry pre-service teachers who listed skin cancer as the effect of global warming. However, it is a misconception as skin cancer is not a direct effect of global warming; it happens due to the thinning of the ozone layer. There was another misconception by a Physics pre-service teacher that listed down the lengthening of summer time as the effect of global warming. Maybe the respondent wanted to talk about the increase in global temperature or drought but could not think of the right words. The following excerpts quote what had mentioned by the respondents:

"…It causes the temperature of earth to increase and skin cancer…" (Respondent Q)
"Global warming is dangerous as it can cause cancer to our skin……" (Respondent O)
"…Climate change affected like having too long of summer time…" (Respondent S)

The observations made during the SCE552 class involved the discussion of the topics related to the environment as mentioned previously. The researchers who were also the instructors of the course made the observations to the three different groups involved in the study and noticed the following: the pre-service science teacher's were cooperative in learning the topic and felt less burden to participate in the class activities they responded to the questions posed either by the presenters or instructor indicates high interest in learning the topics they had ideas that they could share during the class but some of the ideas highlighted were not explained in-depth, i.e., the causes or effect related to environmental phenomenon, the underlying scientific concept related to the specific environmental issue. They felt connected to the topics presented as it has such a strong relation to them they reacted accordingly to the stimulus presented in class, i.e., anger towards the human's activities that polluted the environment, appreciate the aesthetic value of the environment, feel grateful to the ecosystem services and condemned the misused of scientific knowledge that bring harm to the environment and society.

Based on the interviews and the observations conducted, the researchers found out that pre-service Chemistry and Biology teachers seem to have a slightly higher level of environmental knowledge and awareness as compared to the pre-service Physics teachers who had more tendencies to have misconceptions in environmental information. The respondents asserted that they have interest on the environmental knowledge maybe because they could relate the environment to their own life. Besides, it is crucial for them to be well-informed about the information related to the environment as the SCE552 course required them to be prepared with such information for discussion and classroom activities. Consequently, as the respondents were interested about the knowledge, they used a few sources to acquire more knowledge on environment. Nonetheless, some of the respondents showed a lack of interest in environmental knowledge. Perhaps, they were unable to relate the environment to their life and they assumed that environmental knowledge as unimportant to be compared to their discipline subjects. Despite lack of interest, all of them were equipped with the current environmental issue as they managed to list down the most recent environmental issues worldwide. Overall, the study found that the pre-service science teachers have relatively high environmental knowledge and awareness. These results suggested the similarities with the findings from other studies which claimed the pre-service teachers have high level of environmental knowledge and awareness (Karpudewan and Ismail, 2012; Tuncer *et al*., 2009). It is also parallel with another study which reported that pre-service science teachers hold some misconceptions related to the environmental knowldedge (Boubonari *et al*., 2013).

The effectiveness of SCE552 course in instilling environmental knowledge and awareness: The ultimate aim of SCE552 is to introduce science, technology, society and environmental education to the pre-service science teachers. One of the objectives is to promote environmental knowledge and awareness to the pre-service science teachers. In this study, the effectiveness of SCE552 is gauge through the effectiveness of the course in delivering the environmental knowledge and instilling the environmental awareness to the pre-service science teachers how the course helps them in translating the knowledge into good environmental attitude-defined as a tendency for someone to be attentive and caring to the natural environment. Based on both interview and observation, the researchers found that all of the respondents were able to narrate the lessons they have learnt through the SCE552 course even though the breadth and the depth of the narration differed from one respondent to another highlight the important points shared by the their colleagues during the presentation relate the topic discussed in class with their surroundings make suggestions or give opinion pertaining to the environmental issues discussed. The engagement by the respondents during the class as well as the feedbacks obtained through the interviews evidently support that to some extent this course has successfully provided the pre-service teachers with sufficient knowledge as well as awareness on the environment. However, this is insufficient to claim the effectiveness of the course as there is a need to gauge to what extent the course is able to help the pre-service science teachers to translate the theory and awareness into practice. A study claimed that, high environmental knowledge and awareness leads to positive environmental attitude (Esa, 2010). Based on the interviews, the researchers found that the pre-service science teachers have positive environmental attitude but at the moderate level even though their levels of environmental knowledge and awareness were relatively high. Based on

their responses, the researchers found two factors affecting the environmental attitude which were their internal and external motivations. The internal motivations are affected by their own environmental knowledge and awareness as discussed beforehand while the external motivations come from their parents and family members. Researchers were able to make a proclamation that the course did contribute to the pro-environmental practices as an internal motivation factor as the course provides the pre-service teachers with knowledge and awareness. This is asserted by the response from the respondents which stated that they possess good environmental attitude because they have good environmental awareness. Furthermore, they responded that the awareness come from the knowledge they have on the environment. Nonetheless they admitted that they did not practice the pro-environmental behavior as they mentioned in class or during the interview indicating that the internalization of the knowledge and value gained from the course to some extent did not happen which in-lined with the study that suggested good environmental knowledge may not be translated into positive environmental practices (Peer *et al*., 2007). These are as stated in the following excerpts:

> "…Honestly I know and aware of what are the consequences of not doing things like reduce or recycle but I don't really practice those things.." (Respondent F)
> "…I help environment by not throwing rubbish at the designated place but I hope many people out there will do more than what I do…" (Respondent H)
> "…I know it is important to take care of the environment but I do what I am capable of not more not less, I am not hardworking as it will takes a lot of efforts to sort out your household garbage for the sake of recycling…" (Respondent A)

When the researchers asked the respondents, the factor (s) that could contribute to the effectiveness of the course in enhancing the pre-service science teacher's knowledge, awareness and attitude on the environment, most of the respondents agreed upon that the method used in conducting the lesson which emphasised on active learning would be among the key factor besides the role of the course instructor. Literatures assert that active learning enhances student's mental involvement in the learning process and consequently improves their performance. Further analysis of the responses gathered noted that there were a few constraints that limit the effectiveness of the course in instilling the environmental awareness and knowledge. One of the constraints was the knowledge and competency of the pre-service teachers in presenting the topic. The pre-service teachers are responsible to deliver the knowledge to their classmates under the supervision of the lecturer. The topics given were too broad, thus, the respondents had difficulties to deliver the knowledge effectively and carry out substantive discussion for the better understanding of the topic. Consequently, the other pre-service science teachers may face difficulties in grasping the knowledge without further elaboration by the course instructors. However, despite the barriers listed, analysis showed that there was an increase in the environmental knowledge and awareness of the pre-service science teachers and a slight change in the environmental attitude after they took the SCE552 course. This could be the indicator to claim that the course is relatively effective however require further improvement to enhance its effectiveness. Nevertheless, this course is considered important as there is lack of environmental education in teacher's trainings and this makes environmental knowledge and awareness difficult to be integrated in school syllabus (Peer *et al*., 2007).

CONCLUSION

The findings of the study noted that the pre-service science teachers have relatively high environmental knowledge and awareness reflected through their ability to give appropriate response towards the questions asked related to the environment. Their engagement in class and also the idea they shared during the class discussion and activities were also factored in to make such proclamation the SCE552 course is considered to be effective as it is able to impart the knowledge and instill the awareness related to the environment. Nonetheless, the course still needs to be improved to ensure that the knowledge and awareness gained by the pre-service teachers could be internalized and translated into pro-environmental behavior. The study recommended that a more structured guideline is provided to the pre-service science teachers in helping them in preparing the information related to their presentation topics the instructors need to be actively engaged in the class discussion and provide in depth elaborations and justifications on the issues discussed pertaining to the environment active learning should be practiced in any environmental-related course to enhance the effectiveness of the course courses that similar to SCE552 should be empowered and upgraded in any teacher training institutions for better integration of environmental knowledge and awareness for the future teachers.

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