

PRE-SERVICE TEACHERS' UNDERSTANDING AND AWARENESS OF SUSTAINABLE DEVELOPMENT CONCEPTS AND TRADITIONAL ENVIRONMENTAL CONCEPTS

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Abstract: This paper discusses the findings from a survey conducted to investigate the level of awareness and understanding of traditional environmental concepts and sustainable development concepts among pre-service teachers. The survey involved 110 pre-service teachers enrolled in the chemistry teaching methods course. The student teachers were requested to complete a set of 20-item questionnaire on environmental knowledge. Awareness and understanding of concepts central to sustainable development is particularly significant for the pre-service teachers who are required to educate and promote education for sustainable development. Results of the study showed that the pre-service teachers have a low level of awareness and understanding of concepts central to sustainable development compare to traditional environmental concepts. Recognising the importance of sustainability knowledge in leading sustainable lifestyle, the findings of this paper emphasise the need impart sustainable development knowledge through teaching and learning process.

Keywords: sustainable development concepts, traditional environmental concepts, pre-service teachers

Abstrak: Kertas kerja ini membincangkan dapatan kajian yang telah dijalankan untuk mengenalpasti tahap kesedaran and pemahaman guru pelatih terhadap konsep alam sekitar yang lebih tradisional dan konsep perkembangan lestari. Seramai 110 guru pelatih yang mengikuti kaedah mengajar kimia terlibat dalam kajian ini. Dalam kajian ini, guru-guru pelatih dikehendaki menjawab soal selidik yang mengandungi 20 soalan yang menguji tahap pemahaman pelajar tentang konsep alam sekitar. Tahap pemahaman pengetahuan konsep alam sekitar dalam kalangan guru pelatih adalah penting kerana golongan inilah yang bertanggungjawab untuk mengembangkan pendidikan untuk perkembangan lestari. Dapatan kajian menunjukkan guru-guru pelatih mempunyai tahap pemahaman yang rendah tentang konsep perkembangan lestari berbanding konsep alam sekitar yang lebih tradisional. Memandangkan guru-guru pelatih memainkan peranan yang penting dalam perkembangan pendidikan lestari, golongan ini perlu diberikan pendedahan yang lebih mendalam tentang konsep lestari.

Kata kunci: konsep perkembangan lestari, konsep alam sekitar tradisional, guru-guru pelatih

INTRODUCTION

The importance of Environmental Education (EE) in enhancing awareness towards the environment is undeniable. As Tikka, Kuitunen and Tynys (2000) noted, acquisition of nature-related knowledge determines the attitudes and behaviour of an individual. Lianne (2005) observed significant positive effect of students' awareness of the environment and their knowledge of environmental concepts in her study. A study by Yencken, Fien and Sykes (2000) on Environment, Education and Society in Asia Pacific also indicates the existence of strong relationship between environmental knowledge and environmental behaviour. Additionally, Barraza and Walford (2002) claimed that there is a link between environmental knowledge and development of positive attitudes toward the environment. Environmental education can help to create awareness, concern, and recognition of the consequences of people's actions, and promote environmentally responsible behaviour (Salequzzaman & Stocker, 2001; Bradley, Waliczek, & Zajicek, 1999; Fien, 1997).

Lack of environmental knowledge could be accounted as one of the reasons for the occurrence of many environment related problems such as global warming, depletion of ozone and accumulation of solid waste. The importance of knowledge in determining behaviour was argued by Ajzen and Fishbein (1985) through their theory of reasoned action. According to them, attitude change can and will deliver behaviour change. Attitude change can be attained through appropriate knowledge. Ajzen and Fishbein (1985) claimed that knowledge that focuses only on the explanation of the importance of something (knowledge transfer) would not likely succeed in changing attitude and behaviour. Rather, the knowledge should convince people to carry their intention to change, by giving a lot of attention to attitudes, subjective norms and perceived behaviour control.

The knowledge system for sustainable development explicitly addresses the complex interactions between people, resources, environment and development (McKeown, Hopkins, Rizzi, & Chrystalbridge, 2002). McKeown et al. (2002) asserted that education for sustainable development is a process of learning how to make decisions that consider long-term future of the economy, ecology and social well being of all communities. Sustainable development knowledge cultivates decision-making ability, critical thinking and problem solving skills. These attributes empower learners to participate in decision-making and ethically address the problems they might encounter in their daily life. Teaching and learning in line with sustainability emphasise holistic, multi-disciplinary approach in order to develop knowledge and skills needed for sustainable future as well as changes in values, behaviour and lifestyles. Recognising the importance of knowledge on sustainability, this study was thus conducted to investigate the pre-service teachers' awareness and understanding of Traditional

Environmental Concepts (TECs) and Sustainable Development Concepts (SDCs) in the Malaysian context.

BACKGROUND OF THE STUDY

The United Nation (UN) Conference on the Human Environment held in Stockholm in 1972, which endorses environmental education in its 'Recommendation 96' is recognised as a milestone for global adoption of EE. The importance of education in changing human attitude was also stated in *Our Common Future* (World Commission on Environmental and Development [WCED], 1987). In the same year, in the International Congress on EE, UNESCO/UNEP endorsed the Tbilisi's principle of EE. *Our Common Future* which is also known as the *Brundtland Report* has led to the Earth Summit, in Brazil in 1992. The Earth Summit, in *Agenda 21*, reiterates the role of education in mobilising the society towards a sustainable development. *Agenda 21* puts forward the role of education in pursuing development that respects and nurtures the natural environment and focuses on re-orienting the existing education framework to foster values and attitudes towards environment as well as, envisioning the ways and means of doing so.

The Malaysian Government has integrated environmental considerations into the formulation of projects and programs since the Sixth Malaysian Plan (1991–1995) in order to address environmental problems (Economic Planning Unit, 1991). This was further strengthened in the Seventh Malaysia Plan (1996–2000), the Eighth Malaysia Plan (2001–2005) and in the Ninth Malaysian Plan (2006–2010). Each plan's requirements are intended to ensure efficient management of the environment and its natural resources in order to attain sustainable development. Among the key strategies taken by the Government in environmental education are:

1. broad-based campaigns through the mass media to encourage the life-long process of Environmental Education (EE);
2. infusing formal EE in the school curriculum;
3. incorporating an EE subject in teacher training;
4. establishment of a Research Centre for Environmental Health; and
5. active participation of public and private sectors including non-governmental organizations in promoting environmentally responsible practices.

(Economic Planning Unit, 1996)

The Economic Planning Unit of the Prime Minister's Department, as the country's implementer of *Agenda 21* reported that the Ministry of Education has actively

advocated for the development of a curriculum that has elements of environmental education. The National Report of Malaysia on Development of Education prepared by the Ministry of Education (2004) stated that the ministry has infused environmental issues into subjects such as Man and Environment in primary schools. In the secondary schools, environmental issues are infused through geography and the sciences (Ministry of Education, 2004). The importance of protecting the environment is in fact manifested as one of the aims of science curriculum. Other aims of the science curriculum for secondary schools include providing students with the knowledge and skills in science and technology and enable them to solve problems and make decisions in everyday life based on scientific attitudes and noble values. The curriculum also aims to develop a concerned, dynamic and progressive society with a science and technology culture that values nature and works towards the preservation and conservation of the environment (Curriculum Development Centre [CDC], 2006). EE also has also been included in the teacher education programme (Abdul Rashid, Sharifah, & Hashimah, 2006).

A study by Mageswary, Zurida and Norita (2006) on attitudes and actions of Malaysian students towards environmental problem showed that the students were not very enthusiastic in solving environmental problems. Sharifah and Hashimah (2006) reported that there is still considerable apathy among Malaysian students to engage pro-actively in environmental behaviours. It was reported that "the root cause of environmental problems in Malaysia today is none other than the very low environmental awareness within society". Aini, Fakhru-Razi, Laily and Jariah (2003) reported that although Malaysian in-service teachers possess a considerable level of environmental knowledge, they lack a general understanding of the underlying causes of the environmental problems. They also reported that the practises of environmental behaviour among teachers are not in concert with the level of environmental concern and knowledge. This circumstance prevails despite the fact that EE is being infused into conventional school subjects and included in the teacher education programme.

One possible explanation for this situation could be attributed to the fact that EE imparted is not sufficient to develop environmental responsible behaviours. A study by Nadeson and Abdul Rashid (2005) claimed that within the National Education System (NES), the framework for implementation of EE is uncoordinated and not structured towards effectiveness. Hence, they proposed nine recommendations so that EE will be effectively integrated and infused into the NES. Daniel, Nadeson and Abd Ghani (2008) proposed establishing smart partnerships mainly with the NGOs to train teachers and develop curriculum to enhance the infusion of EE in Malaysian education. Sterling (1992) proposed that for education to be the agent of change towards sustainable society, it needs to

include the understanding of local environmental issues and political, economical and social structure. One of the approaches to bring local and global environmental, societal and economic issues into education is through the implementation of the knowledge system that harnesses sustainability (Rahman, 2000). Therefore, this exploratory study was undertaken to evaluate the pre-service teachers' awareness and understanding of Traditional Environmental Concepts (TECs) and Sustainable Development Concepts (SDCs). Comprehension and recognition of the pre-service teachers TECs and SDCs may help provide information for revision and improvements in the effort of providing education as envisaged in the Malaysian National Philosophy of Education.

Education in Malaysia is an on-going effort towards further developing the potential of individuals in a holistic and integrated manner, so as to produce individuals who are intellectually, spiritually, emotionally and physically balanced and harmonious based on a firm belief in and devotion to God. Such an effort is designed to produce Malaysian citizens who are knowledgeable and competent, who possess high moral standards and who are responsible and capable of achieving a high level of personal wellbeing as well as being able to contribute to the betterment of the family, society and the nation at large (CDC, 2006).

METHOD

The purpose of this study is to investigate the pre-service teachers' awareness and understanding of SDCs and TECs. A total of 110 pre-service teachers were involved in this study. The subjects were enrolled in a chemistry teaching methods course. At the time of the study, the subjects were either in their second or third year of the Science Education Degree Program. In order to accomplish the purpose of the study, a modified version of the Questionnaire on Environmental Knowledge developed by Yencken et al. (2000) was used. The original questionnaire contained 12 items: 8 items evaluated the understanding of TEC and 4 items on SDC. The modified version contained 20 items. The first item focused on investigating the pre-service teachers' level of awareness of the environmental concepts, 12 items evaluated the understanding of TECs and 7 on SDCs. The subjects took almost an hour to complete the questionnaire. The collected data was analysed using SPSS. Prior to this study, a pilot study was conducted to validate the questionnaire items. The content of the revised version was validated by experts in Education for Sustainable Development (ESD). Cronbach's alpha of 0.8856 was obtained, indicating items in the questionnaire were highly reliable.

RESULTS AND DISCUSSIONS

Table 1. Pre-service teachers' awareness of the environmental concepts

Concepts	<i>N</i>	Frequency	Percentage (%)
Ozone layer	110	107	98
Greenhouse effect	110	104	95
Ecology	110	99	90
Renewable resources	110	90	82
Biodiversity	110	82	75
Carbon cycle	110	71	65
Interdependence	110	66	60
Sustainable development	110	55	50
Eco-efficiency	110	38	35
Carrying capacity	110	36	33
Ecological footprint	110	25	23
The precautionary principle	110	16	15
Intergenerational equity	110	5	5

Table 1 shows the results on pre-service teachers' awareness of environmental concepts based on item 1 of the questionnaire. Frequency values indicate the said number of students have heard of the concepts. The results showed that the pre-service teachers were highly aware of the following concepts: ozone layer (98%), greenhouse effect (95%), ecology (90%), renewable resources (82%), and biodiversity (75%). These are considered TECs (Yencken et al., 2000) and have been integrated into the existing curriculum (Abdul Rashid, et al., 2006; Sharifah & Hashimah, 2006). Additionally, co-curricular activities with environmental themes which embrace traditional concepts were also conducted in schools (Ministry of Education, 2004). Credit should also be given to the media for highlighting the environmental issues and crisis such as the frequent and devastating natural disasters, global warming and climate change. Consequently, students were very much aware of green houses gases and ozone layer, which are considered the contributors to global warming and climate change. The results in Table 1 also indicate that the pre-service teachers were moderately aware of carbon cycle (65%), interdependence (60%) and sustainable development (50%). Carbon cycle is one of the TECs. Interdependence and sustainable development are SDCs. The pre-service teachers showed low level awareness of the following concepts: eco-efficiency (35%), carrying capacity (33%), ecological footprint (23%), precautionary principle (15%) and intergenerational equity (5%). These are SDCs, and are considered new. These concepts have yet to be integrated into the curriculum, hence, the low level of awareness. However, even though

interdependence and sustainable development are referred to as SDCs, the pre-service teachers were moderately aware of these concepts. This is probably due to the fact that sustainable development concept is practiced in the university through the university's involvement in sustainability endeavours. Sustainability activities currently in practice in Universiti Sains Malaysia include training and research in renewable energy and energy efficiency, recycling of waste, USM Going Green Project which bans the use of polystyrene containers as well as other non reusable containers. For the interdependence concept, it is already in the secondary science curriculum (CDC, 2006).

Table 2. Pre-service teachers understanding of the environmental concepts

Environmental concepts	<i>N</i>	Frequency	Scores (%)
Water pollution	110	104	95
Haze	110	100	91
Solid waste accumulation	110	98	89
Global warming	110	94	86
Ecology	110	93	85
Deforestation	110	88	80
Ozone layer	110	81	74
Greenhouse effect	110	80	73
Biodiversity	110	75	69
Renewable resources	110	73	67
Carbon cycle	110	60	55
Biodegradable	110	58	53
Interdependence	110	55	50
Sustainable development	110	27	25
Eco-efficiency	110	23	21
Carrying capacity	110	20	19
Ecological footprint	110	19	18
The precautionary principle	110	13	12
Intergenerational equity	110	11	10

Table 2 shows the results on pre-service teachers' understanding of environmental concepts based on items 2–20 of the questionnaire. Frequency values indicate the number of students who have given right answers for the concepts tested. The scores indicate the percentage of right answers given for the particular concept. The results showed that the pre-service teachers possess better understanding of the following concepts: water pollution (95%), haze (91%), solid waste accumulation (89%), global warming (86%), ecology (85%), deforestation (80%), ozone layer (74%), greenhouse effect (73%), biodiversity (69%),

renewable resources (67%), carbon cycle (51%) and biodegradable (53%). According to Yencken et al. (2000), these concepts are referred to as TECs. These concepts have been included in the school curriculum, and at the time of this study, these concepts were also frequently reported in the local media. The northern region of Malaysia where the study was conducted has just recovered from haze due to forest fire from the neighbouring country. The Malaysian Government has always strongly emphasised the need to recycle to overcome the solid waste accumulation and this effort is being promoted through the media. Global warming and greenhouse effects were highlighted in the media when the United Nations Climate Change Conference was held at Bali, Indonesia around the time the study was conducted. With Malaysia being one of the main producer of palm oil, the issues of using palm oil to produce biodiesel has been strongly argued. Accordingly, the term renewable resource was frequently mentioned. However, the terms carbon cycle and biodegradable were rarely mentioned. The pre-service teachers' understanding of carbon cycle and biodegradable were mostly based on what they have learned in schools.

The results in Table 2 indicate that the pre-service teachers understanding of carbon cycle and biodegradable concepts are comparatively lower than other TECs. This perhaps, could be due to the nature of the education system in Malaysia which is very much exam oriented. The exam oriented education system which requires rote memorising of facts could lead to the minimal understanding. The concepts were memorised for the purpose of examination and disregarded after the exam. Therefore, the exact definitions of the concepts were not remembered since this study was conducted four years after the students sat for their major examination. The findings of this study were contrary to Yencken et al's. (2000) claim. Yencken asserted that greater awareness leads to greater understanding. Probably, this is because Yencken's study involved school going children while this study involved pre-service teachers. Pre-service teachers have left schools and currently these students were not following environment related courses.

As indicated in Table 2, the pre-service teachers were observed to have lower understanding of the following concepts: interdependence (50%), sustainable development (25%), eco-efficiency (21%), carrying capacity (19%), ecological footprint (18%), precautionary principle (12%), and intergenerational equity (10%). According to Yencken et al., (2000), the concepts are referred to as SDCs and yet to be included in the curriculum. However, the term interdependence is found in the secondary school science curriculum. This explains the pre-service teachers' better understanding of interdependence compared to the other SDCs.

Table 3. Comparison of pre-service teachers understanding of TECs and SDCs

Concepts	<i>N</i>	Range of scores	Mean scores	Standard deviation
TECs	110	1–10	6.54	6.067
SDCs	110	1–6	2.79	2.075

Table 3 shows the range, mean scores and standard deviation for the entire TECs and SDCs. In total there are 12 items on TECs and 7 items on SDCs in the questionnaire. The scores for TEC ranged from 1–10 with a mean of 6.54 and the scores for SDC ranged from 1–6 with a mean score of 2.79. Accordingly, findings from this study indicate that relatively, pre-service teacher's awareness and understanding of TECs are higher than SDCs.

The infusion of EE into the curriculum primarily could partly explain the results of the study (Ministry of Education, 2004). However, the emergence of environmental issues mainly due to humans' activities (Oskamp, 2000) portrays that the knowledge failed to develop relevant behaviours. This is consistent with Yencken et al.'s (2000) assertion that people are becoming increasingly aware of the environmental dangers. People today have the knowledge about global warming, rising ocean levels, thinning of the ozone layer, and destruction of the worlds' forest and extinction of species. Despite the existence of knowledge and awareness of environmental issues, environmental disasters continue to take place. It could be surmised that the knowledge that students possessed did not influence their attitudes and behaviours. The knowledge that the students seemed to have about the environment is mainly proportional in nature rather than procedural; i.e. it is "*knowledge about the environment*" rather than "*knowledge on how to work for the environment*" (Yencken et al., 2000). This could explain the ambivalence between the students' expressed concern and their general lack of willingness to change their personal life-style and other actions to protect the environment (Mageswary et al., 2006). The failure of knowledge of TECs in developing appropriate behaviours illustrates that TECs basically provide description of particular environmental concepts. As such, learning of TECs failed to shape values that drive an individual and failed to bridge the gap between knowledge and action. This is in consonant with Ajzen and Fishbein's (1985) claim that knowledge that focuses only on explaining importance of something (knowledge transfer) will likely not succeed in changing attitude and behaviour.

SDCs are less discipline specific and more sustainable development related. Integration of SDCs will allow students to relate the knowledge learned in classroom to the life beyond the classroom. For instance "Generating Electricity" is a topic included in the Form 3 science syllabus of Integrated Science Curriculum for Secondary schools. The objective of this lesson is to expose the

students with various sources used for generating electricity. Examples of renewable and non-renewable resources were also discussed. The objectives generally emphasises the importance of scientific concepts and not the significance of understanding these concepts within students' everyday living. However, when the science concepts are integrated with SDCs, the relevancy of the science concepts with everyday living could be highlighted.

For instance, integration of *Interdependence*, one of the SDCs with the subject matter provides an opportunity to relate energy resources to economic, society and environmental consequences. Students need to analyse the impact of natural resource exhaustion on the economic of a country. Consumption of energy releases carbon dioxide and other greenhouses gases. Hence, the lesson on generating electricity is associated with environmental consequences such as global warming and climate change. Instilling the right attitudes of opting for renewable resources relates the lesson to societal consequences. Additionally, by allowing the students to carry out *life cycle analysis or assessment* of a particular source of energy, the students were provided with an opportunity to develop their decision-making ability. Extensive reviewing of literature is required while working on life cycle analysis. The students have to locate entire aspects inherent to those particular resources from the beginning to the end (including waste generation and management). Integration of SDCs provides opportunities for the implementation of student-centred deep learning approach. Ultimately, when the students come across similar problems in their real life, they will recognise the problem and are competent to solve the problem. Thus, SDCs enhances the problem solving skills of the learners as well.

Cognitive knowledge embodies what we know and understand and how we describe, comprehend, apply, analyse, synthesise and evaluate the understanding of knowledge inherent to the subject matter (Bloom, 1956). The affective domain expands the lesson to different levels to include life beyond the classroom and is accountable for developing our values, attitudes and behaviours. According to Krathwohl, Bloom and Masia (1973) affective domain includes the manner in which we deal with things emotionally such as feelings, values, appreciation, enthusiasms, motivation and attitudes. Affective learning outcome is noted by Shephard (2008) as the central learning element for Education for Sustainable Development. Consequently, SDC is a transparent technique to deliver affective domain innate to cognitive domain. SDCs create a route for imparting affective domain in relation to the cognitive domain.

However, despite the importance of SDCs, the findings from this study indicate the pre-service teachers were relatively less aware and possessed minimal understandings of SDCs. Exposing pre-service teachers with sustainable development concept perhaps could overcome the claim made by Mohamed

Zohir and Sharifah (2005) and Aini et al. (2007). Mohd Zohir and Sharifah (2005) reported that 51% of in-service teachers have "only a little knowledge" or "no knowledge at all" when asked "How much do you think you know about Education for Sustainable Development?". Meanwhile 28% pre-service teachers responded that they do not know anything while 15% indicated that they knew something about Education for Sustainable Development. Aini et al. (2007) claimed that the Malaysian students were unclear in defining sustainable development and the students' understanding on the concept of environment is rather shallow. It is therefore, timely to impart knowledge of sustainability to the learners.

CONCLUSION

SDCs are recognised as knowledge systems that intermediates action and knowledge. Teaching and learning of SDCs provides an opportunity for students to reflect on real world scenario and it is a deep learning student-centred approach. SDCs promote decision-making and problem solving skills of the learners and promotes affective domain of the learners as well. However, the finding of this study indicates that pre-service teachers' awareness, as well as the understanding of SDCs is vague. Pre-service teachers have better understanding of TECs which make them better aware of the environmental issues and problems but unable to act on the awareness. As such this study proposes that the pre-service teachers be introduced to SDCs as these teachers have the potential to influence many teacher and students in future. One way of implementing this value-based education is through integrating SDCs across the discipline into all the subjects taught in schools. Additionally, the pre-service teachers should be introduced with new teaching approach or pedagogical knowledge which requires them to integrate SDCs in their teaching. In service teachers could be exposed with SDCs through professional development courses.

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