The Infusion of Environmental Values in Science Classroom: Primary School Teachers' Views and Practices

Nur Farha Shaafi[1*], Nurul Nabilla Mohammad Khalipah[2], Nur Syamimi Shafie[3], Muhamad Furkan Mat Salleh[3]

[1]Material Technology Programme, Faculty of Industrial Sciences and Technology, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang, Kuantan Pahang, Malaysia

[2]Sekolah Menengah Integrasi Sains Tahfiz D/A Masjid Saidina Othman Ibnu Affan Jalan Budiman, Bandar Tun Razak, 56000 Cheras, Kuala Lumpur

[3]Science Education Department, Faculty of Education, Universiti Teknologi MARA Cawangan Selangor, Kampus Puncak Alam, 42300 Bandar Puncak Alam, Selangor, Malaysia

*farhashaafi@yahoo.com

Received: 14 October 2021
Received in revised form: 25 November 2021
Accepted: 30 November 2021
Published: 31 December 2021

ABSTRACT

The immense challenge in producing eminence generation would be significant in sustaining the environment calls. Various studies of environmental stewardship could be integrated into teaching and learning. The study aims to investigate primary school science teachers' views on the importance and strategies of infusing environmental values in the class. Based on qualitative research design, the interviews were used as the primary strategy to gather the data of this study supported with document analysis. Seven primary school science teachers were conveniently selected to be participants in this study. Their teaching experiences were 9 to 20 years and currently serve in different primary schools in Malaysia. The majority of the participants agreed that the infusion of environmental values in the science classroom is deemed as crucial due to several justifications i.e., love and concern towards the environment, safety and comfort life, health condition, and science content is strongly related to the environment. The emerging themes are common topics, active learning strategy, authentic examples approach, informal classroom culture, and targeted environmental values chosen by teachers. The study concludes that it is imperative for teachers to play their roles to ensure that environmental values could be successfully imparted to students during teaching and learning at school. The strategy to infuse the environmental values should be considered and planned thoroughly by teachers to ensure the positive and significant impact on students. Future studies should be conducted to look for the best classroom practices which effectively infuse environmental values to the students at various educational levels.

Keywords
Teaching science; Primary school; Environmental values; Awareness

Introduction

Environmental quality has deteriorated to a worrisome level due to domestic, urban waste pollution, and industrial pollution; inducing a global problem that affects human activities. This serious situation was influenced by water pollution, air pollution, thinning of the ozone layer, deforestation and declination of natural resources, global warming, and acid rain crises (Yaacob, Hameed, & Ismail, 2003). An increasing level of air pollution could have resulted from the burning of viz., industrial fossil fuel, forest and domestic waste, energy production and transportation (Slattery & Rapp, 2003). The environmental degradation was induced by human activities; developed environmental pollution and decrement of nature resources (Mustam, 2017). A study conducted by Ahmad, Juhdi and Awadz (2010) in one university in Malaysia showed that the respondents were still unfamiliar with certain environmental terms and concepts despite having high environmental knowledge (Ahmad, Juhdi, & Awadz, 2010). This study showed that four (4) out of six (6) behaviour-based environmental attitude dimensions (energy conservation, mobility and transportation, waste avoidance, green consumerism, recycling, and positive attitude towards conservation) perceived pro-environmental behaviour.

Environmental awareness was vital to be fostered in contemporary life; emphasized an interdependence in humankind to that of the natural world (Orr, 2003; Richards, 2001). A study conducted by Mei, Wai and Ahamad (2016) on environmental awareness and behaviour index among Malaysian denotes that a strong environmental awareness level

does not indicate a greater environmental behaviour level (Mei, Wai, & Ahamad, 2016). The study concluded that the four categories of environmental issues, i.e., sound, air, water, and soil pollutions. Malaysians have the highest awareness of water pollution and reflect the highest intention to conduct conservative action simultaneously. However, it is notable to mention that the result showed the opposite for climate change, waste management and air quality protection and to a large extent affect the environmental behaviour towards the issues, i.e., (i) environment degradation due to water pollution, air pollution, thinning of the ozone layer, deforestation, declination of natural resources, the increment of temperature and acid rain problem (Yaacob et al., 2003), and (ii) increment rate of air pollution due to the burning of fossil fuel in the industry, open burning of forest and domestic waste, the production of energy and transportation (Perera, 2018).

Education is a crucial element in enhancing pupils' awareness of the environment due to the school's role in shaping and transforming society; supported by Nelson Mandela; quoted that "education is the most powerful weapon you can use to change the world" (Tsinober, 2014). In Malaysia, Environmental Education (EE) has been established in the curriculum. Education has been established and validated as the most significant platform for future citizens to confront and deal with current emerging environmental issues (Abdullah & Hiang, 2015; Cullingford, 1995). A study by Teng, Quoquab, Mohammad & Mahadi (2017) concur that creating environmental awareness and values is best to be done through education (Teng, Quoquab, Mohammad, & Mahadi, 2017). This study stated that the sustainable development values could be implemented in primary, secondary and tertiary education levels.

Salleh, Zuki, Ismail, and Abdullah (2016) reported that secondary school students possessed substantial knowledge of environmental issues and good attitudes towards the environment (Salleh, Zuki, Ismail, & Abdullah, 2016). However, they have moderate awareness of environmental issues. The study recommended teachers integrate environmental issues and promote environmental awareness as they teach any related topics. Furthermore, a large gap in environmental knowledge and a significant drop in environmental behaviors and attitudes among secondary school students in Sabah (Fah & Sirisena, 2014). A study on primary school students' perceptions in Malaysia towards EE by Abdullah, Hamid, Shafii, Wee and Ahmad (2018) revealed that the respondents' environmental awareness is modest. They have various concepts to define the environment (Cheah, 2019). Respondents' perceptions of the importance of protecting the environment show that all parties should work together to create a harmonious and balanced environment. The study suggested that environmental awareness can be improved and preserved by various parties.

In educating environmental issues, it is essential, to begin with, the young generation that would inherit Earth's survival. For that reason, teachers are responsible for developing students' environmental awareness in the classroom. A conducive learning and teaching method conducted by teachers would help students develop skills, values, and knowledge in sustainability. Hanifah, Shaharuddin, Mohmadisa, Nasir & Yazid (2015) found that environmental program initiatives among teachers and school students are excellent and successful initiatives to promote positive environmental behaviour. The study concluded that it is essential to have agents in schools such as teachers that can continuously provide information and knowledge on conservation and preservation of the environment. Science subject is believed to be the most relevant for fostering environmental awareness among pupils based on the strong relation of science content with environmental issues. However, the integration of environmental awareness among students is influenced by teachers' efforts to include environmental issues in their discussions and teaching.

Therefore, this study sets out to achieve the following objectives: (i) to investigate primary school science teachers' views on the importance of infusing environmental values in their class; and (ii) to examine the strategies that they use in order to for them to infuse environmental values in their teaching.

Literature Review

Despite undergoing rapid economic development, Malaysia has been one of the countries that facing environmental problems. Environmental Department (2007; 2006; 2005) has discovered that Malaysia is meeting with environmental problems such as sound pollution, air pollution, water pollution, soil pollution, illegal waste material, the oil spill in the sea and others. These problems cannot be treated as minor problems because they will become worst from day today. Thus, if no early action is taken, our young generation will suffer from unmanaged environmental problems.

To produce a young generation with high awareness towards the environment, education has been a medium to instill environmental issues during the teaching and learning process. Therefore, National Education Philosophy (NEP) has mentioned that education is the continuous effort to produce balance and harmony from intellect, emotion, physical

and spiritual. Following the NEP, EE has been introduced in Malaysia to enhance students' knowledge, understanding, and awareness of the environment (Rahim, 1995). Besides that, Environmental Education aims to produce the human population who are sensitive and concerned towards the environment and all matters related to it (Moseley, 2000).

There are two types of education in Malaysia which are formal and informal (Daniel, 2006). Formal education consists of primary and secondary schools. These schools are under the law, order and monitoring of the Ministry of Education (MOE). The formal and informal education approach would improve on long-term and short-term potentials respectively through the private sector and non-government organization (NGO) (Rosnani, 2000).

To teach environmental awareness and instill values about environment protection, through the formal education of EE that the Ministry of Education has developed, various teaching and learning strategies have been executed in school. The student's awareness towards the environment was increasing, yet less in their action and practice towards sustaining the environment (Aini Mat Said, Nurizan Yahaya, & Fakhru'l-Razi Ahmadun, 2007).

'Environmental Education across the Curriculum' was established in primary and secondary schools to be infused in each subject school. The EE subject has been effectively implemented in, i.e., Denmark (Larsen & Azizi, 2000) and Japan (Susan Pudin, Koji Tagi, Ambigavathi Periasamy, 2002) compared to that of Malaysia educational system. Therefore, the mastery level of the students in Malaysia based on the knowledge could not be assessed and reported as other academic subjects (Mohd. Yusop Abdul Hadi, Ahmad Esa, & Ghazali Spahat, 2000). After several years of research, the EE aspect has been integrated into all elementary and secondary school subjects in Malaysia across the curriculum. Many activities were suggested and loaded into 'Huraian Sukatan Pelajaran'. However, the aim of EE (as illustrated in Table 2c – 2h) in Malaysia is not fully achieved.

The integration of EE with the teaching process in the classroom has been one of the educational efforts to promote environmental awareness (Mohd Zohir & Nordin, 2007). Thus, 'Buku Panduan Guru Pendidikan Alam Sekitar' was launched in 1998 by 'Curriculum Development Centre of the Ministry of Education Malaysia. The books are used as guidance for the teachers in implementing EE across the curriculum for primary and secondary schools.

Besides that, the Ministry of Education also uses appropriate programs and relevant requirements to increase environmental awareness among students towards achieving vision 2020. The Ministry of Education (Marchioro et al.) has tried to update the subject of the environment in their strategies. Thus, in Table 1, the researcher has provided the analysis of the policies, strategy and action plan by the Ministry of Education (Nadson & Rashid, 2005).

Table 1: Policies, Strategies and Action Plans in Malaysia

No.	National Policy/plan	Strategies/action Plan/statement
1.	National Policy on Biodiversity (1998)	Incorporate the study of biological diversity and related fields into the curricular od schools and institutions of higher learning
2.	National Policy on the Environment (2002)	To achieve a deeper and better understanding of the concepts of environmentally sound and sustainable development and caring attitude towards nature, EE and awareness will be promoted across the board, incorporating information dissemination and training, in line with Agenda 21
3.	National Integrity Plan (2004)	Community institution-emphasizing on increasing the awareness of environmental conservation
4.	9th Malaysia Plan (2006-2010)	Appropriate intervention and changes will be made through the school curriculum to create a deeper and longer lasting awareness for the environment. In addition, the energy, ideas, enthusiasm of the environmental will be harnesses by the government to complement and supplement the efforts in promoting safe environment.

Source: Nadson & Rashid (2010)

The enhancement of environmental awareness has been one of the essential elements towards achieving sustainable development (Zurina and Norjan, 2003). Nowadays, society only focuses on economic and development aspects and neglects the environment (Wang, Cardon, Liu, & Madni, 2020). Many studies have been conducted to survey the

knowledge, attitude and awareness towards the environment among students, especially students in the educational institution. It was found that the knowledge, attitude, and environmental issues among students in a higher educational institution in Malaysia was at a reasonable level (Norlila 2007, Ismail 2005; Norjan et al. 2005; Seow & Nor Wariza Jufri, 2004; Mohd Yusop et al. 2003; Ramli 2003; Zurina & Norjan 2003; Ruhaya 2001; Fadzilah 1999). This finding was inlined with Ridener (1997) that mainly mentioned students have high environmental awareness.

However, based on the research carried out on the attitude aspect, it was found that the level of involvement of the students is low. Zurina and Norjan (2003) proved that the level of awareness among university students in Universiti Kebangsaan Malaysia (UKM) was high. Still, the involvement of the students in preventing environmental issues is too minimum. This finding has attracted researchers' attention to find more about teachers' and students' awareness of environmental issues from past research. The level of environmental awareness among universities students is at a high level. However, minimum readiness of the students was reported to overcome the environmental issues (Zurina & Norjan, 2003). The knowledge and behaviour of the students are at a high level but with a moderate level of practice towards the environment (Mohd Yusop, 2003). These findings are in good agreement with that of the reported research by Azizan (2008), which stated that the students' awareness of the environment is good, but this awareness could not be changed to become a practice.

In Malaysia, based on the study by Masitah, Azizi and Ahmad Makmon (2011), involving 263 teachers from 30 secondary schools in Perlis, Selangor, Pahang, Melaka, and Sarawak reported that the level of teachers' knowledge and awareness towards environmental issues are in moderate level. Besides, findings from a study have shown that the level of a primary school headmaster in Kuala Lumpur is moderate as well (Ika Liana, Azizi, Rosta & Ismi Ariff, 2011).

Besides that, Shahnawaj (1990) surveyed the environmental awareness and attitudes of secondary and higher secondary school teachers in another developing country, i.e., Pakistan. The research found that environmental awareness is low. To enhance environmental awareness, Kollmuss and Agyeman (2002) have developed a behaviour model. From the model, they emphasized how knowledge about the environment could help improve the awareness and behaviour of an individual. Samuel (1993) finds out that even the teachers have awareness towards environment among teachers, but the knowledge about the environment is insufficient. These findings are also supported by Wahida et al. (2004), who said that the awareness towards environmental issues and the awareness about the environment should be conserved have increased among the community. However, the involvement of the individuals in the conservation activities is still low.

This phenomenon occurred in another developed foreign country, based on a variety of previous research that shows the community has 23 awareness towards various environmental problems, including local environmental issues to the global concern such as global warming and thinning of the ozone layer. However, the responsibility attitudes still have not become their habits. The weaknesses of the community are the attitudes of making other people easiness in conserving the environment as prioritized (Berenguer, 2007). The way of action towards environmental issues should go beyond the awareness (Atsuko, 1999).

A descriptive study by Fong (2005) in two Selangor schools agrees with results reported by Sharifah et al. (2005) the students understanding of environmental issues was at surface level in Malaysia. In general, the students' knowledge about the environment was high, while awareness and sensitivity were low.

To foster environmental awareness, science teachers and science educators could use environmental issues, problems and science ideas, precisely the environmental dimension (Wals, 2011; Littledyke, 2008; Slattery, 2003). This is also supported by other researchers who that mention even though Science education has its limitation, it also can provide few chances for fostering environmental awareness (Littledyke, 2008, 1996). In addition, for the past two decades, science educators have addressed the importance of environmental awareness (Yager, 2007; Bybee, 2005; 1997, 1993; Pedretti, 2005; Hodson, 2004, 2003; Hurd, 1998; Roth & Lee, 2004).

Similarly, environmental awareness is closely related to environmental attitudes, actions and knowledge (Menze, 2010) or ability, affecting students' attitudes (Dimopoulos, Paraskevopoulos & Pantis, 2009). Besides that, critical thinking is also related to environmental awareness (Wals, 2011). The fact that environmental awareness is broadly defined as knowledge, critical thinking, and attitudes can be clarified by the concept of awareness, since it is the awareness that

causes a change in perspective, necessary for a change in attitude, which, in turn, is a precondition for a change in behaviour and action.

It is obvious that the awareness of the importance of certain science facts and ideas stems from the awareness of the specific connection between self and the environment, which is required for the development of environmental awareness. Littledyke (2008) proposed that the so-called 'big ideas' of science, besides offering the most interesting and significant contributions of science, the ideas of science are to help integrate science concepts with real life experiences linked with environmental impacts. Given that these ideas help integrate the cognitive and the affective domain, their potential in fostering environmental awareness should be seriously taken into account. Attention also should be given so that the explicit connection between self and Nature are integrated by the science concepts with real environmental experiences.

In Malaysian education system, Science subject has been taught both in primary and secondary schools. Based on School Regulation 1967, it was compulsory to teach Science in primary school (Sharifah & Lewin, 1993). Science subject was established in primary school since 60 and 70's. However, in the 80's there is some changes occurred in which students were learnt science in subjects like environment and man rather than in one specific subject. Since 2003, science subject has become the core subjects in primary school and it has been taught as early as year 1(7 years old).

Science syllabus does not only contain science facts but also knowledge of environmental education-related. The environmental awareness must be focus in the science subject contents (Sharifah & Lilia (2007). Therefore, it seems that the syllabus can give a meaningful insight to the primary students about environmental issues because science courses constitute the scientific and technological issues surrounding the environmental problems (Gill & Burke,1999).

There are eight objectives to achieve in the Malaysian science curriculum for primary schools (Lee et. al, 2004):

- Stimulate pupils' curiosity and develop their interest about the world around them
- Provide pupils with the opportunities to develop science process skills and thinking skills
- Develop pupils' creativity
- Provide pupils with the basic science knowledge and concepts
- To provide learning opportunities for pupils to apply knowledge and skills in a creative and critical manner for problem solving and decision-making
- Inculcate scientific attitudes and positive values
- Foster the appreciation on the contribution of science and technology towards national development and well-being of mankind
- Be aware the need to love and care for the environment

The last objective refers to the environment, with the purpose to nurture the love and care for the environment. This shows that the government is concern about what is happening to the environment and it is hoping that the primary school students will gain more knowledge about the environment and will interact positively with the knowledge. The content of primary school science syllabus is structured around themes. Noble values are listed as positive attitudes towards environment and need to be achieved as a science learning experiences along with the scientific values (Hassan, 2009).

Since this study focuses on teaching and learning of science, researchers has provided the themes content in the KSSR Science syllabus as shown in Table 2 (a) and Table 2 (b).

Table 2 (a): Themes Content in The Science Syllabus

Levels	Years	Themes
1	1	Learning about living things
	2	Learning about the world US
	3	-
2	4	Investigating living things
	5	Investigating force and energy
	6	Investigating materials

		Investigating the earth and universe Investigating technology

Sources: Lee et. al (2004)

Table 2 (b): Themes Related to Environmental Knowledge

Years	Theme	Content
Level 1 1-3	Learning about living things	The theme introduces pupils to living things and non-living things. Pupil can learn about themselves, animals and plants around them. Pupils also learn about senses, good health, good habits and some of the life processes that humans undergo.
Level 2 4-6	Investigating living things/environment	The theme introduces pupils to the basic understanding about the basic needs of living things, life process, interactions among living things survive and create a balance in nature. This theme also, focuses on life processes in man for pupils to understand themselves. It also, explains why man is special compared to the other living things.
	Investigating energy and force	The theme introduces the basic physical quantities through, which pupils are exposed to the principles of measurement, the use of standard units and the importance of using standard units. The theme also includes light, heat, sound, energy, movement and electricity. Pupils are introduced to force and speed too at this level.
	Investigating materials	This theme aims to provide pupils the opportunities to investigate natural materials and man-made materials. Pupils are use their knowledge about physical properties of materials and relate them to their use. The theme also includes the study of the formation of clouds and rains. Acid, alkali and neutral substances are also introduced. It also enables pupils to understand how things around them rust and how food is preserved. Finally, an exposure to issues on waste disposal will create an awareness that man needs to play a responsible role in an effort to manage nature wisely.

Sources: Lee et. al (2004)

From Table 2 (c) and 2 (d), we can see that the subject related to the environment can only be traced in the themes. There are seven themes for both level 1 to level 2. Among those themes, there are only four themes related to environmental knowledge which are the first theme is learning about living things (Year 1), the second theme is investigating living things (Year 4), the third theme is investigating force and energy (Year 5) and the fourth theme is investigating materials (Year 6). Thus, it shows that easily for the science teachers to infuse environmental issues as there were four themes related to environment. Table 2 (c) to 2 (h) shows the learning objectives because it encompasses the learning activities and learning outcomes of environmental related topic that fall under four themes as mention before.

Table 2 (c): Learning Objectives of Environmentally-Related Topic Year 1

Year	Theme	Topic	Learning objectives
1	Learning about living things	Plants	The names of different plants The names of different parts of plants That plants need water to grow That plants need sunlight to grow That plants grow

Table 2 (d): Learning Objectives of Environmentally-Related Topic Year 2

Year	Theme	Topic	Learning objectives
2	Learning about living things	Animals	What animals need to live The different foods that animals eat That animals grow
2	Learning about living things	Plants	That plants need the right amount of water for healthy growth That flowering plants produce seeds which grow into new plants

Sources: Lee et. al (2004)

Table 2 (e): Learning Objectives of Environmentally-Related Topic Year 3

Year	Theme	Topic	Learning objectives
3	Learning about living things	Animals	To observe and recognize external features of animals That animals can be grouped in many ways
3	Learning about living things	Plants	To observe and recognize external features of plants That plants can be grouped according to external features That plants can be grouped in many ways
3	Learning about living things	Soil	What soil is made up of The flow of water through different types of soil That certain soils are more suitable for plant growth

Sources: Lee et. al (2004)

Table 2 (f): Learning Objectives of Environmentally-Related Topic Year 4

Year	Theme	Topic	Learning objectives
4	Learning about living things	Living things have basic needs	Understanding that human have basic needs Understanding that animals have basic needs Understanding that plants have basic needs
4	Learning about living things	Living things undergo life processes	Analyzing life processes in humans Being aware that certain behavior can disturb life processes Analyzing the life process in animals Understanding the life processes in plants
4	Learning about living things	Animals and plants protect themselves	Understanding that animals have specific characteristics and behavior to protect themselves from danger Understanding that animals have specific characteristics and behavior to protect themselves from extreme weather Understanding that animals have specific and behavior to enable them to survive Understanding that plants have specific characteristics to protect themselves from enemies

Sources: Lee et. al (2004)

Table 2 (g): Learning Objectives of Environmentally-Related Topic Year 5

Year	Theme	Topic	Learning objectives
5	Investigating force and energy	Microorganism	Understanding that microorganism is a living thing Understanding that some microorganisms are harmful and some are useful
5	Investigating force and energy	Survival of the species	Understanding that different animals have their own ways to ensure the survival of their species Understanding that different plants have their own ways to ensure the survival of their species realizing the importance of survival of the species

5	Investigating force and energy	Food chain and food webs	Understanding food chains Synthesizing food chains to construct food web
5	Investigating force and energy	Energy	Understanding the uses of energy Understanding that energy can be transformed from one form to another Understanding the renewable and nonrenewable energy
5	Investigating force and energy	States of matter	Understanding that matter can change from one state to another Understanding the water cycle Appreciating the importance of water resources

Sources: Lee et. al (2004)

Table 2 (h): Learning Objectives of Environmentally-Related Topic Year 6

Year	Theme	Topic	Learning objectives
6	Investigating living things	Interaction among living things	Understanding that some animals live in groups and others live in solitary Understanding that competition is a form of interaction among living things Understanding the responsibility of human beings in protecting endangered species Knowing the impact of human activities on environment
6	Investigating living materials	Waste management	Understanding the effects of improper disposal of waste on the environment Understanding that some waste can decay

Sources: Lee et. al (2004)

Methods

The study was set out to investigate primary school science teachers' views and classroom practices. The researchers used the qualitative research design as it was deemed to yield an in-depth insight into the phenomena. The data was obtained using semi-structured interviews, which were supported with the analysis of the documents (see Table 3) related to the study area. There were in total of seven participants involved in the study selected through a convenience sampling procedure. These participants are primary school science teachers who have teaching experience ranging from 9 to 20 years. They serve the primary school in different areas in Malaysia, namely Selangor, Kuala Lumpur, and Negeri Sembilan. During this study, the participants are pursuing their bachelor's degree as part-time students in the e-Long Distance Education program in one public university in Selangor, Malaysia. The study interviews were conducted in the group (two respondents per one group) due to time constraints. To ensure the data gathered are rich and descriptive, the researchers took about 40 to 60 minutes to interview each group and used probing to elicit responses from the participants. The interviews were transcribed and analyzed immediately after each session. The processes allowed the researcher to get further clarification from the participants on uncertain responses given during the interview. The data analysis was conducted thematically to find the emerging codes and themes that will be used to answer the research questions.

Table 3: Analysis of Documents

No.	List of Interview Questions for Primary School Science Teacher
1.	*Apakah pandangan cikgu mengenai keadaan alam sekitar kita pada ketika ini?*
2.	*Siapakah yang memainkan peranan untuk memastikan alam sekitar kita terus terpelihara?*
3.	*Pentingkah pendidikan alam sekitar diperkenalkan/ditekankan di sekolah?*
4.	*Sebagai guru sains,apa pendapat cikgu mengenai kesedaran alam sekitar dan rasa cinta terhadap alam sekitar di kalangan murid-murid sekolah?*
5.	*Boleh cikgu bagi contoh,apa yang murid-murid buat yang menunjukkan kesedaran mereka adalah tinggi?*
6.	*Perlukah nilai mengenai alam sekitar di masukkan dalam pengajaran sains di sekolah? Jika ya,mengapakah nilai alam sekitar perlu diterapkan dalam pengajaran sains?*

7.	*Adakah cikgu sendiri ada menerapkan nilai mengenai alam sekitar di dalam pengajaran cikgu? Jika ya,bagaimana dan apakah kaedah yang digunapakai?*
8.	*Apakah nilai alam sekitar yang sering diterapkan dalam pengajaran sains di sekolah?*
9.	*Apakah kebaikan nilai alam sekitar tersebut dalam diri seorang pelajar?*
10.	*Apakah topik di dalam subjek sains yang menjadi pilihan cikgu untuk menerapkan nilai alam sekitar?*
11.	*Mengapakah topik tersebut menjadi pilihan cikgu? Dan bagaimana topik tersebut dapat memberi impak yang berkesan dalam menerapkan nilai alam sekitar?*
12.	*Pada pandangan cikgu,apakah kaedah yang terbaik untuk menerapkan mengenai nilai alam sekitar kepada pelajar?*
13.	*Apakah sumber rujukan cikgu dalam menerapkan nilai alam sekitar dalam pengajarn sains? Dan bagaimana sumber tersebut membantu cikgu?*
14.	*Pada pandangan cikgu,apakah cara yang terbaik bagi menerapkan nilai alam sekitar dalam kalangan pelajar di sekolah?*
15.	*Pada pandangan cikgu,adakah sebarang kursus atau seminar diperlukan bagi memperkasakan keberkesanan penerapan nilai alam sekitar dalam pengajaran sains? Jika ya,mengapa?*
16.	*Apakah cabaran/halangan yang dihadapi oleh guru sains dalam menerapkan nilai alam sekitar dalam pengajaran sains?*

Results and Discussions

The results and discussion of the study will be discussed according to the objectives of the study, which are: (i) primary school science teachers' views on the importance of infusing environmental values in their class and; (ii) the strategies that they used for them to infuse the environmental values in a science lesson. The subsequent headings herein report on the themes that emerged from each objective. For systematic reporting and ease of reference, all seven participants were labelled using the alphabet from A to G. The actual name for each participant was not disclosed for confidentiality purposes.

Views on the importance of infusing environmental values in the science classroom

Based on the responses given by the respondents, the researchers managed to cluster them into several themes that could be used to fulfill the first objective of the study (Summers, Kruger, Childs, & Mant, 2000). The themes are as the followings:

(i) Love and concern towards the environment

The interview data showed that the teachers realize the importance of environmental awareness among the students. This indicates that the teachers were possessing responsibility to change the educational experiences of students beyond the classroom wall; diversifying the learning opportunities and approaches on environmental sustainability in the real-life situation. In the other word, the infusion between environmental issues and class activities should be implemented in the formal learning session (Sata, Wongpho, & Chankong, 2015). In general, teachers could observe that the importance of environmental awareness among the students were highly rooted from the schools.

The environmental subject agreed to be proposed and implemented in schools; resulting a strengthen awareness and spirit instillation among the students towards the environment. Apart of learning process, the environmental based activities would contribute to i.e., (i) professional and instructional leadership, (ii) pedagogical strategies, (iii) effective communication among students, and (iv) human-relation in protecting the environment. The environmental-based activities could subsequently develop emotional connection from the practical learning experiences with the nature (Lasen, Skamp, & Simoncini, 2017; Thomas, 2018). Some of the notable responses were given:

"…To ensure the students love the environment…" (Teacher E)
"…The students are aware towards environmental issues and working hard to solve them…" (Teacher F)

This also encouraged teachers to additional response in the school. This is evidenced by:

"…The students could be aware towards the importance of sustaining the environment…" (Teacher G)

The above responses clearly show that teachers are genuinely concerned on students' awareness towards the environmental changes that had been taken place surrounding them. Such finding verified by the literature entitled '*Kesedaran Guru Terhadap Masalah dan Isu Alam Sekitar*' by Latipah Ab. Hamid, Wahida Ibrahim and Gan Ler Qi from the Faculty of Education, Universiti Teknologi Mara. The quantitative approach was implemented using distributed questionnaire to 115 primary school teachers in Muar, Johor. The investigation was focusing on teachers' awareness towards current environmental issues. The result showed teachers' awareness towards i.e., (i) pollution at score range of 3.395 to 3.890, and (ii) environmental issues at the average of 4.124 (see Table 4). This indicates that the level of teachers' awareness on pollution is in a good agreement with their awareness on the environmental problems. The environmental care and concern among teachers were vital for a good attitude encouragement among the students subsequently (Darling-Hammond, Flook, Cook-Harvey, Barron, & Osher, 2020).

Table 4: The Minimum Average of Teachers' Awareness towards Environmental Education Component

Component in environmental education	Min Average	Min Interpretation
Ecology Foundation	3.472	High
Environmental issue and problem	4.124	Very High
Sustainable development	4.022	Very High
Enviro**n**mental education across curriculum	3.570	High
Citizen's environment	3.793	High
Minimum average score for all fifth component	3.796	High

(ii) Safety and comfort life

The purpose of understanding the environment values could lead to a comfortable living, which subsequently improve the quality of life in communities. The concept of environmental awareness was created to facilitate the society's reactions towards the environment. According to Tao (2014), a living condition was the most crucial in one's life. It was stated that a good life would be achieved with a good environmental condition (Tao, 2015). Among the responses given include safety and comfort life as stated in the following excerpts:

"…Comfort for all living things in current and future life..." (Teacher C)
"…Students will be healthy and free from illness…" (Teacher D)

Referring to this domain, it was clearly stated that the higher quality of future life is deemed to be obtained from a good quality of environment; resulted from a high awareness toward environmental values.

(iii) Health condition and hygiene

The highlighted opinions by teachers were benefits of environmental cleanliness and hygiene; yielded a safe and non-infected learning area for the students. The habituating effort has been implemented due to provision of educational facilities in their school. This included i.e., (i) reuse, reduce, and recycle (3R) bins at school corner, (ii) duty schedule 'green garden', (iii) clean classroom competition, and (iv) class cleaning with classroom teacher during first class period in time table. This would promote a pro-environmental behavior among the students; producing positive citizens for the nation which maintaining the nature (Mulyana, 2009).

The teachers' reactions vary, among which include:

"…Students can understand the importance of environmental hygiene, they will always practice wherever they are, so the environment in Malaysia will remain clean and beautiful without any waste being dumped anywhere..." (Teacher A)
"…Pupils are always disciplined in practicing hygiene in their daily lives..." (Teacher B)

Upon analysis of data, teachers agreed that the students were deemed as having substantial environmental awareness; they managed to appoint the list of cleanliness activities due to environmental care which were very much in line with Miranda Carreño & Blanco (2010) findings (Miranda Carreño & Blanco Suárez, 2010).

(iv) Science content are strongly related to the environment

Science is used as a tool to increase students' awareness towards conserving and preserving the environment. The ways science could help foster awareness among the students were related with human life and living organism. Most of realistic issues i.e., (i) human life, and (ii) animals, (iii) environment, and (iv) living organisms were discussed in

Science lesson; connected with the environmental awareness among the school students (Gupta, LaMarca, Rank, & Flinner, 2018). This statement was supported by Yilmaz, Boone and Anderson (2004) stated that the main topics in science curriculum were word and universe, matter and energy, living organisms, and natural resources in relation to the awareness about the environmental issues (Yilmaz, Boone, & Andersen, 2004). At this point, Littledyke (2008) has reported that science education obtains significance in terms of developing environmental concepts and promoting the pro-environmental behavior (Littledyke, 2008). Prior researches demonstrated that the answers given by the respondents were accurate and it is probably due to the maximum exposure of contents towards the environmental issues covered in science subject (Gokmenoglu, Eret, & Kiraz, 2011).

Strategies to infuse environmental values in the science classroom

As for the strategy, the researchers categorized the codes into five emerging themes which are as the followings:

(i) Common topics that the teachers use

The infusion of environmental issues in teaching and learning Science subject would lead to the environmental value instillation among students. Several aspects were expected from the teachers regarding the reliability of themes in science subject in correlation with the environment; categorized as i.e., (i) Living Things and Technology, (ii) Living Things, Energy and Force, and Material, and (iv) all themes in science subject. The common topics were listed: (i) '*Manusia*', '*Tumbuh-tumbuhan*', '*Keperluan Benda Hidup*', (ii) '*Perkembangan Teknologi'*, and (iii) Life, Physical, and Material Sciences respectively. The responses given in the following excerpts:

"…Science Year 2: Topic 1 is Human. Humans are contributing factors to the environmental pollution. Therefore, this title is appropriate in chapter 1 in line with the CPC, KPM curriculum…" (Teacher A)
"…Technology development. In technology development course, students will be exposed to new creations to improve the standard of human life. Hence, teachers can focus on the importance of being a caring individual for the environment regardless any changes in technology…" (Teacher E)
"…Importance of water resources. Students need to explain the importance of sustaining a clean water clean…" (Teacher F)
"…Year 1 grows plant. I find out that this topic is relevant as it relates with plants. Students can appreciate the importance of taking care of their plant…" (Teacher G)

These topics were significant for a mind-awakening regarding human roles for environmental health, understanding the role of plants to keep a good environment, awareness on the importance of clean water resources for future supplies, and enhancement of technology for green environment. In fact, Malaysian Science curriculum in National Educational Philosophy (NPE) aimed to infuse the desirable values and attitudes in teaching Science curriculum viz., responsibility, cooperation, and perseverance towards the environment (Al-Hudawi, Musah, & Fong, 2014). This statement was agreed by Farida et. al (2017), teaching and learning in Science could facilitate the students to develop higher order thinking ability and attitude for sustaining the environment (Farida, Hadiansyah, Mahmud, & Munandar, 2017).

(ii) The active learning strategy

Students should be taught by using a variety tool which involve active learning. The rationale of active learning (experience learning) aims to help the students to understand environmental education in a critical way by integrating the active interaction with that of the outdoors lesson reported by Robertson and Krugly-Smolska (1997) (Robertson & Krugly-Smolska, 1997). Brooks and Brooks (1993) reported that the hierarchal relationships of earth science is deemed as crucial to build a fundamental macro-knowledge among students before focusing on traditional science curriculum (Brooks & Brooks, 1999). As stated in active learning, teacher D encourages the students for practicing recycling in the science lesson to keep active in maintaining the nature. The steps taken in recycling activities are re-utilization of used plastic bottles to plant the medicinal plants. In spite of learning the theory and science concepts, recycling activities could be expected to yield a useful product. According to Rahmat (2009), the embedded of environmental ethics is significant in education (Mulyana, 2009); which would develop the positive character among students oriented to environment through active learning process (Asmani, 2011; Ridlo & Irsadi, 2012).

(iii) Authentic examples approach

The inclusion of authentic approaches regarding the environmental issues through the methods of viz., simulation, role-play, story-telling, open-discussion, experiments, group projects, computer-assisted learning activities, and video critics; suggested to have potentials to enhance primary school students' knowledge and awareness on environment. These kinesthetic learning activities (KLAs) is the sensory-motor learning which the physical learning activities could

be transferred into mental symbols representing the experience (Olson, 2015). In the literature investigation, Price, Dunn, and Sanders (1980) reported that most of young children are kinesthetic and experience a gradual development of visual strengths in elementary grades (Price, Dunn, & Sanders, 1981). KLAs could engage other significant learning styles based on Felder and Silverman's active, sensing, visual, intuitive, and global learners (Felder & Silverman, 1988).

(iv) Informal classroom culture

The environmental value could be nurtured by informal education. The informal approaches could be stimulated by giving a clear instruction for the students to conduct class cleaning before teaching and learning process begin, field trips, behavior modification, and encouraging recycle activities. All respondents were unanimously agreed that the practical methods in formal education would highly instill the environmental values among the students. The teaching contents should be relatable with that of the current sources of internet and books; corresponded to the response from respondent C. The students' participation is however should be intensively monitored by teachers to maintain their learning enthusiasm. The philosophy of 'learning-by-doing' should be cultured in Malaysian paradigm to yield an excellence learning outcomes; which practiced in United States (Hudson, 2001). The informal education could be speculated to increase the consciousness of individuals without the formal educational system (Ors, 2012).

(v) Targeted environmental values chose by the teachers

The highest achievement in *'Dasar Alam Sekitar'* implementation was *'Sekolah Lestari'* which exhibits several principles and green strategies for sustainable development (Mahat, Ahmad, Che Ngah, & Ali, 2014). Education and awareness aspects should be highlighted in these strategies for environmental conservation and preservation; which required viz., knowledge, understanding, attitude changes, and community involvement. This matter should be nurtured at an early age; implemented in school students to sustain a living environment. The implemented environment values in school were divided into four categories i.e., (i) respect the earth, (ii) sustain the ecosystem, (iii) protect the ecosystem, (iv) conserve the environment. Thus, most of the themes in science subject were in a good agreement with that of protecting and conserving the environment; which would be intensively infused in teaching and learning process. The findings were focusing on positive values towards the environmental care. In addition, the integration of environmental values were promoted with feasible characteristics viz., humble, cooperation, respecting the universe or earth, balance life, sustainable ecosystem, conserve wild animals and biodiversity, minimal damage, continuous changing, economy is not everything, recognize rights for future generation, individual responsibility, simplicity or moderation, ecosystem protection and conservation, ethics rather than punish, experience and appreciate is better, and loves the environment.

Conclusion

This explorative study indicated that the majority of science teachers agreed that the infusion of environmental values in the science classroom is vital due to several justifications, including (i) love and concern towards the environment; (ii) safety and comfort life; (iii) health condition; and (iv) science content, was strongly related to the environment. The five emerging themes, i.e., (i) common topics, (ii) active learning, (iii) authentic approach, (iv) informal classroom culture, and (v) targeted environmental values, were hypothesized as practical strategies to infuse environmental values in the science classroom. To realize Malaysia's aspiration, science teachers should be proactive and cooperative in integrating environmental issues with teaching and learning. The holistic environmental values that have been cultured among students at an early age would undoubtedly sustain the health of the environment in future.

Limitations and Future Studies

The limitations of the study could be observed in the sample size of respondents. The limited scope of data collection would affect the data validation. The data validation would be significant for the reliability of the study. Thus, the sample size and instrumentation should be highlighted in future research. The first recommendation is to enlarge the sample size of respondents to get more information about the infusion of environmental value, more respondents, therefore the data collection would be enriched. The data would be generalized to the whole population. The following recommendation is to vary the instrumentation, which is using interviews for data collection. Therefore, researchers would gain information from the other party to enrich the data. Besides, the observation technique is also relevant to record the students' performance and response during the teaching and learning process.

References

Abdullah, N. H. L., & Hiang, L. M. (2015). Kajian pemboleh-pemboleh ubah yang mempengaruhi aras pengetahuan, tindakan dan kesedaran murid sekolah rendah di Johor terhadap isu alam sekitar. Universiti Tun Hussein Onn Malaysia.

Ahmad, S. N. B., Juhdi, N., & Awadz, A. S. (2010). Examination of environmental knowledge and perceived pro-environmental behavior among students of University Tun Abdul Razak, Malaysia. International Journal of Multidisciplinary Thought, 1(1), 328-342.

Al-Hudawi, S. H. V., Musah, M. B., & Fong, R. L. S. (2014). Malaysian national philosophy of education scale: PCA and CFA approaches. Asian Social Science, 10(18), 163.

Asmani, J. (2011). Buku Panduan Internalisasi Karakter Di Indonesia. In: Yogyakarta: Diva Press.

Brooks, J. G., & Brooks, M. G. (1999). In search of understanding: The case for constructivist classrooms: Ascd.

Cheah, K. S. (2019). Implementation of Environmental Education Program (EEP) in A Nature Education School (NES): Strategies, Benefits & Challenges. MOJEM: Malaysian Online Journal of Educational Management, 7(2), 92-121.

Choi, H. S., Liu, W., Misra, P., Tanaka, E., Zimmer, J. P., Ipe, B. I., Frangioni, J. V. (2007). Renal clearance of quantum dots. Nature biotechnology, 25(10), 1165-1170.

Cullingford, C. (1995). Children's attitudes to their local environment. Monitoring change in education, 2, 21-36.

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. Applied Developmental Science, 24(2), 97-140.

Fah, L. Y., & Sirisena, A. (2014). Relationships between the knowledge, attitudes, and behaviour dimensions of environmental literacy: A structural equation modeling approach using smartpls. Jurnal Pemikir Pendidikan, 5.

Farida, I., Hadiansyah, H., Mahmud, M., & Munandar, A. (2017). Project-based learning design for internalization of environmental literacy with islamic values. Jurnal Pendidikan IPA Indonesia, 6(2), 277-284.

Felder, R. M., & Silverman, L. K. (1988). Learning and teaching styles in engineering education. Engineering education, 78(7), 674-681.

Gokmenoglu, T., Eret, E., & Kiraz, E. (2011). The link between Environmental Awareness and Science-related factors: Suggestions for science curriculum. Evaluation in Education in the Balkan Countries, Belgrade.

Gupta, R., LaMarca, N., Rank, S. J., & Flinner, K. (2018). The environment as a pathway to science learning for K–12 learners—A case study of the E-STEM movement. Ecopsychology, 10(4), 228-242.

Hudson, S. J. (2001). Challenges for environmental education: Issues and ideas for the 21st century: Environmental education, a vital component of efforts to solve environmental problems, must stay relevant to the needs and interests of the community and yet constantly adapt to the rapidly changing social and technological landscape. BioScience, 51(4), 283-288.

Lasen, M., Skamp, K., & Simoncini, K. (2017). Teacher perceptions and self-reported practices of education for sustainability in the early years of primary school: An Australian case study. International Journal of Early Childhood, 49(3), 391-410.

Littledyke, M. (2008). Science education for environmental awareness: approaches to integrating cognitive and affective domains. Environmental education research, 14(1), 1-17.

Mahat, H., Ahmad, S., Che Ngah, M. S. Y., & Ali, N. (2014). Pendidikan Pembangunan Lestari-Hubungan kesedaran antara ibu bapa dengan pelajar. GEOGRAFIA OnlineTM Malaysian Journal of Society and Space, 10(5), 71-84.

Marchioro, A., Teuscher, J., Friedrich, D., Kunst, M., Van De Krol, R., Moehl, T., Moser, J.-E. (2014). Unravelling the mechanism of photoinduced charge transfer processes in lead iodide perovskite solar cells. Nature photonics, 8(3), 250-255.

Mei, N. S., Wai, C. W., & Ahamad, R. (2016). Environmental awareness and behaviour index for Malaysia. Procedia-Social and Behavioral Sciences, 222, 668-675.

Miranda Carreño, R., & Blanco Suárez, Á. (2010). Environmental awareness and paper recycling. Cellulose Chemistry and Technology, 44(10), 431-449.

Mulyana, R. (2009). Penanaman etika lingkungan melalui sekolah perduli dan berbudaya lingkungan. Jurnal Tabularasa, 6(2), 175-180.

Mustam, B. (2017). Model Mental Murid Tentang Alam Sekitar Di Satu Kawasan Yang Tercemar. JuKu: Jurnal Kurikulum & Pengajaran Asia Pasifik, 3(4), 36-45.

Olson, M. H. (2015). Introduction to theories of learning: Psychology Press.

Orr, D. (2003). The constitution of nature. Conservation Biology, 17(6), 1478-1484.

Ors, F. (2012). Environmental education and the role of media in environmental education in Turkey. Procedia-Social and Behavioral Sciences, 46, 1339-1342.

Perera, F. (2018). Pollution from fossil-fuel combustion is the leading environmental threat to global pediatric health and equity: Solutions exist. International journal of environmental research and public health, 15(1), 16.

Price, G. E., Dunn, R., & Sanders, W. (1981). Reading Achievment and Learning Style Characteristics. The Clearing House, 54(5), 223-226.

Richards, R. (2001). A new aesthetic for environmental awareness: Chaos theory, the beauty of nature, and our broader humanistic identity. Journal of Humanistic Psychology, 41(2), 59-95.

Ridlo, S., & Irsadi, A. (2012). Pengembangan nilai karakter konservasi berbasis pembelajaran. Jurnal Penelitian Pendidikan, 29(2).

Robertson, C. L., & Krugly-Smolska, E. (1997). Gaps between advocated practices and teaching realities in environmental education. Environmental education research, 3(3), 311-326.

Salleh, M. F. M., Zuki, N. H. M., Ismail, M. H., & Abdullah, N. (2016). Secondary school students' knowledge and awareness on environmental issues. Paper presented at the 7th International Conference on University Learning and Teaching (InCULT 2014) Proceedings.

Sata, Y., Wongpho, B., & Chankong, U. (2015). Development of a Learning activity management model with the community learning sources for environmental education. Paper presented at the International Forum of Teaching and Studies.

Slattery, P., & Rapp, D. (2003). Slattery, Patrick, and Dana Rapp, Ethics and the Foundations of Education: Teaching Convictions in a Postmodern World. Boston: Allyn & Bacon, 2003.

Summers, M., Kruger, C., Childs, A., & Mant, J. (2000). Primary school teachers' understanding of environmental issues: an interview study.

Tao, L. W. (2015). Living conditions—The key issue of housing development in Beijing Fengtai District. HBRC Journal, 11(1), 136-142.

Teng, F., Quoquab, F., Mohammad, J., & Mahadi, N. (2017). How to Inculcate Sustainable Development Values among Malaysian Citizens? Journal of Engineering and Applied Sciences, 12(6), 1458-1462.

Thomas, G. J. (2018). Pedagogical frameworks in outdoor and environmental education. Journal of Outdoor and Environmental Education, 21(2), 173-185.

Tsinober, A. (2014). Essential Quotations. In The Essence of Turbulence as a Physical Phenomenon (pp. 143-150): Springer.

Wang, C., Cardon, P. W., Liu, J., & Madni, G. R. (2020). Social and economic factors responsible for environmental performance: A global analysis. Plos one, 15(8), e0237597.

Yaacob, M. R., Hameed, R. S., & Ismail, N. R. N. (2003). Perceptions of educated consumers on environmentally friendly products in the East Coast of Peninsular Malaysia. Malaysian Journal of Consumer and Family Economics, 6(1), 42-49.

Yilmaz, O., Boone, W. J., & Andersen, H. O. (2004). Views of elementary and middle school Turkish students toward environmental issues. International Journal of Science Education, 26(12), 1527-1546.