

Environmental Literacy among Adults at Open University Malaysia

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Abstract

As an Open Distance Learning provider, Open University Malaysia is in the position to promote environmental education through its Lifelong Learning framework. Environmental Literacy was introduced through a topic in one of its university courses. This study aims to develop an environmental literacy assessment tool to measure the level of environmental literacy among -first year students who are well distributed across the country. This research adopts a quantitative approach using survey instruments. The first set of data was collected through an online survey by targeting new learners from the Learning Skills for 21st Century course. A total of 1861 learners were enrolled in this course in May 2019 Semester. Only 162 responses were analysed (8.7%). The assessment environmental literacy framework proposed by the North American Association for Environmental Education was adopted in this study. The level of knowledge of the students was proven to be high with mean score ranging from 3.86 to 4.33. The findings suggest that the effort to create environmentally literate adults through formal environmental education can be an effective measure.

Keywords: *Open and Distance Learning, Environmental Education, Environmental Literacy, Knowledge, Disposition*

Introduction

In realising a sustainable living lifestyle, the involvement of everyone is crucial. Every human being must be responsible for greening our environment and build a sustainable world. According to Gunduz (1998), a solution can only be found if the number of environmentally conscious people is increased. There is a significant concern over environmental issues and the extent it affects our day-to-day activities worldwide. Besides, rapid urbanisation also caused environmental degradation, and the root causes of these occurrences were prompted by satisfying human needs through aggressive economic activities (Neo, Choong, & Ahamad, 2016). Among the environmental issues widely discussed in Malaysia are air pollution from the industrial and transport sector; water pollution from raw sewage; deforestation; smoke and haze, waste production, and climate change. On the other hand, the government has taken steps to address environmental issues under the initiatives by The Ministry of Energy, Science, Technology, Environment and Climate Change, which are to strengthen the enforcement action, improve the engagement with the industries and to cultivate education through environmental programmes. Nevertheless, there is much to be done to increase the awareness for individuals to take ownership of their own responsibilities. In line with the government effort, the most viable means to do so is to promote environmental education.

As an Open Distance Learning (ODL) provider, OUM is in the position to promote environmental education through its Lifelong Learning framework. Environmental education is defined as the education process of individuals in gaining the necessary information and skills and increasing their motivations and attitudes in putting forward ideas to find solutions to environmental problems and to behave in an environmentally friendly manner (United Nations Educational, Scientific and Cultural Organization [UNESCO], 1978). An environmentally literate individual is able to comprehend the relationship between natural and social systems, beliefs in the unity of human beings and nature, and is aware of the effects of technological developments on the environment.

Literature Review

Environmental problems today are global issues, and every Malaysian ought to possess knowledge on local and global environmental concerns through formal or non-formal education. Efforts to create environmentally literate adults have resulted in the introduction of several forms of environmental education throughout the world in the past. In UNESCO's Tbilisi Intergovernmental Conference, goals and objectives were established along with the guiding principles on environmental education (UNESCO, 1978a, 1978b). In addition, the awareness of the ecosystem and the consequences of their actions were extended during the United Nations Conference on Environment and Development (UNESCO, 1992). The most important way to overcome environmental problems is to create environmentally literate individuals.

The earliest environmental literacy framework developed by Hungerford et al. (1980) suggested curriculum goals at four levels: Ecological foundation level, Conceptual awareness level, Environmental investigation and evaluation level, and environmental action skills level. Since then, many other researchers have discussed the environmental literacy concept. A comprehensive research-based effort on environmental literacy was carried out by Hollweg et al. (2011). They proposed a framework for an assessment of environmental literacy as an additional component in the Organisation for Economic Co-Operation and Development Programme under OECD for International Student Assessment (PISA) in 2015. According to work carried out, environmental literacy has four interrelated components: knowledge, dispositions, competencies and environmentally responsible

behaviour. This framework was depicted in a more recent research effort on environmental literacy by Liu, Yeh, Liang, Fang & Tsai, 2015).

A person who has environmental literacy skills is defined:

“as someone who, both individually and together with others, makes informed decisions concerning the environment; is willing to act on these decisions to improve the well-being of other individuals, societies, and the global environment; and participates in civic life.” (Hollweg et al., 2011).

This study adopted the North American Association for Environmental Education (NAAEE) framework which consists of four components of measure: (i) knowledge and understanding concerning a wide range of environmental concepts, problems and issues; (ii) a set of cognitive and affective dispositions; (iii) a set of competencies (cognitive skills and abilities); and (iv) appropriate behavioural strategies to apply knowledge in environmental contexts. These components are interconnected. As such the framework must be understood as a progressive development towards environmental literacy of every individual's life. The study focuses on the first two components knowledge and dispositions of the learners.

The aim of this study is also motivated by the 2030 Agenda for Sustainable Development. It consists of 17 Sustainable Development Goals (SDGs) with SDG 4 referring to Quality Education, whereby Goal 4.7 is:

“By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development”.

Under 4.7.1:

“Extent to which (i) global citizenship education and (ii) education for sustainable development, including gender equality and human rights, are mainstreamed at all levels in: (a) national education policies, (b) curricula, (c) teacher education and (d) student assessment.” (United Nation, 2015).

The goal focusing on the knowledge, skills, values, and attitudes required by citizens to lead productive lives, make informed decisions and assume active roles locally and globally in facing and resolving global challenges.

It is crucial to explore the environmental awareness in Malaysia as this will significantly create the chain of reactions on the environmental issues, environmental literacy and also, environmental education. Hassan et al. (2010) expressed the concept of environmental awareness in three dimensions: emotional, attitude and practice of sustainability awareness. In this manner, psychological factors can lead to creating environmentally-friendly actions. Altin et al. (2014) defined environmental awareness concerning environmental issues and active involvement in environmental organisations whereas Karatekin (2014) relates environmental awareness as a trigger element towards positive attitudes and affection towards positive environmental behaviour. The findings by Neo et al. (2016) stated that a strong environmental awareness level does not indicate greater environmental friendly behaviour and that the awareness among Malaysians exist and they do know what needs to be done for the environment but does not translate the intention through actions. Another pertinent finding arising from this study is the environmental behaviour reflected by Malaysians is caused by cost-saving rather than their environmental awareness.

Disposition of an individual can be understood through the following six disposition components: Sensitivity, Attitudes (concern a worldview), Personal responsibilities, Self-efficacy or Locus of control, Motivation, and Intention.

Sensitivity

According to Cabuk and Karacaoglu (2003); environmental sensitivity can be defined as one's willingness to make positive attempts against environmental issues. The development of environmental sensitivity in individuals can be reached through raising the level of consciousness and raising the level of awareness can be possible through appropriate environmental education (Cabuk & Karacaoglu, 2003). Therefore, the indication of environmental sensitivity is the attitudes and behaviours shown by the individuals towards the environment. Environmental sensitivity contains a dynamic structure that can develop throughout life.

Attitudes, concern a worldview

According to Uitto et al. (2004); Hines et al. (1987), environmental attitude is a learned predisposition to respond positively or negatively concerning the environment or environmental events and their effects. Eagly and Chaiken (1993) stated that attitude is a psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour. There are at least two types of environmental attitudes that are known to influence environmental behaviour: attitudes towards the environment and attitudes towards environmental behaviour (Kaiser et al. 1999).

Personal responsibilities

One can assume personal responsibility for environmental issues if he or she is aware of the environmental issues. Personal responsibility is most commonly understood as accepting responsibility for its own actions, or lack of consequences (Mergler & Patton, 2007; Pickard, 2014). It is the ability to regulate one's own thoughts, feelings, and behaviours, along with a willingness to be responsible for choices made based on the social and personal results (Joshi & Rahman, 2015; Manstead, 2018; Mergler, 2008; Pan et al., 2018). Personal responsibility is defined as the belief that someone is the ruler of his life, aware of his choices and goals and is willing to demand accountability for his behaviour and get the consequences (Bennet, 2017; Mergler & Shield, 2016).

Self-efficacy/Locus of control

This factor may be viewed as an output which is also defined as a reflection of inherent focus of control which is promising at revealing the individual's personal behaviour (Rotter 1966). "Self-efficacy refers to one's judgments of their capabilities to organise and execute courses of action required to attain types of performances," (Bandura, 1986, p. 391). Self-efficacy beliefs affect individuals' choice of tasks, their effort, and their persistence. Individuals with high self-efficacy tend to work harder and persist for longer periods of time than less self-efficacious individuals. In related research, Pintrich and Schunk (2002) have shown that teachers who are confident of their ability to improve student's learning often tend to focus on the negative aspects and are less likely to teach successfully.

Motivation

According to Matsumoto (2009), motivation may be defined as the willing investment of effort to accomplish a goal. Motivation is referred as an incentive to act. The conditioning of the incentive can distinct between external and internal factors, which refers to extrinsic and intrinsic motivations, respectively. Intrinsic motivation relates to the involvement in activities

or endeavours for their inherent satisfaction that the individual experiences solely for participating in the act. Extrinsic motivation is related to participating in activities or endeavours for their instrumental value or recognisable expected outcome (Ryan & Deci, 2000)

Intention

According to Brönmark and Hansson, (2002), environmental responsibility behaviour is a result of various situational factors including knowledge of environmental issues and intention to act. Information illustrating the pattern of relations between knowledge of environmental issues and the intention to act has not been widely discussed, but both are considered more partially (Shafii et al., 2019; Yilmaz et al., 2004). Iman et al., (2019) found direct influence between knowledge of environmental issues and the intention to act based on the behaviour of a group of biology teachers. Knowledge of environmental issues influences the behaviour of biology teachers with environmental insight indirectly through the intention to act.

The objectives of this research are to measure perceived: (i) environmental knowledge and skills; and (ii) dispositions among new students at OUM.

Research Method

The research adopted a quantitative approach using a survey instrument. The first set of data was collected through an online survey targeting OUM new learners from OUMH1603 course from various OUM learning centres that are widely distributed across Malaysia. A total of 1861 learners were enrolled in this course in May 2019 Semester. The questionnaire contains two sections: a) demographic profile of OUM learners comprising student ID, gender, age group, mode of entry and the employment industry and b) Environmental knowledge component comprising 10 questions of 5-point Likert scales including one question on prior knowledge of the environment. The questions were based on the content of Topic 10 titled The Environment and Us with 5 sub-topics:

- i. Sub-topic 10.1: Why should we care about the environment?
- ii. Sub-topic 10.2: Global Environmental Issues
- iii. Sub-topic 10.3: Green Technology and Environment
- iv. Sub-topic 10.4: Sustainable Development Goal
- v. Sub-topic 10.5: Ecological Footprint and You

The second set of data was collected involved an instrument for evaluating the disposition of the learners who have responded in the first phase of the study. The instrument used is a set of questionnaires that consists of 3 parts; 1) the disposition items; 2) learning materials; 3) volunteering intention. The collected data was analysed to determine the level of environmental literacy based on the knowledge component and the disposition of the OUM adult learners. The data captured was analysed using SPSS Software version 26.

Findings

Demographic profile

The first part of the survey involving a total of 162 learners (56 male learners and 106 female learners) responded to the questionnaire which focus on the environmental knowledge of environment. Learners were enrolled in the course Learning Skills for 21st

Century and undertake various undergraduate programmes in the university. The demographic profile shows that the three largest portions of learners were between 25-34 years old (43.8%) followed by the age group of 15-24 years old (27.8%) and 35-44 years old (21.6%). A total of 75.3% of learners entered OUM through the normal entry qualification and the remaining 24.7% through the open entry mode. As seen in the employment industry most of the learners were from the government, education/training and manufacturing sector.

Environmental Knowledge Component

Table 1 shows learners with prior knowledge on environment including those have gone through various courses, short courses and training related to the environment. Higher percentage can be seen where 50.6% of the respondents have been exposed to the environmental knowledge through courses, short courses about 45.1% and training the least only 36.4% but 85.2% of respondents have prior knowledge in environment through other channels.

Table 1

Feedback of prior knowledge in environment and relevant courses in environment

Item	Percentage (Yes)	Percentage (No)
Environmental course	50.6	49.4
Short courses related to environment	45.1	54.9
Training related to environmental studies	36.4	63.6
Prior knowledge in environment	85.2	14.8

Sub-topic 10.1 focus on the understanding about the physical and ecological system of the environment which the mean score of respondents were 3.98 whereas the reasons for conserving the environment scored mean 3.90. Overall sub-topic 10.1 under the importance of being a member of global community for the environment scored the highest with mean 4.23. Table 2 identified the mean score of the three main items related to sub-topic 10.1 of the course.

Table 2

Descriptive statistics for sub-topic 10.1: Why should we care about the environment?

Item	Mean Score	Standard Deviation
a) Sub-topic 10.1 improves my understanding about our physical and ecological system.	3.98	1.051
b) I understand the reasons for conserving the environment.	3.90	1.145
c) I understand the importance of being a member of global community without losing the national identity.	4.23	0.735
Average Mean Score	4.04	

The next question under sub-topic 10.2 as shown in Table 3 relates the respondents on the awareness about global environmental issues. The mean scored showed increased awareness among the respondents of 4.33 after reviewing sub-topic 10.2 of the course.

Table 3*Descriptive statistics for sub-topic 10.2: Global Environmental Issues*

Item	Mean Score	Standard Deviation
Sub-topic 10.2 increases my awareness about global environmental issues.	4.33	0.756

Table 4 showed the result of sub-topic 10.3 which the mean score was 4.30. The content of the course highlights the importance of green technology as a solution achieving Sustainable Development Goal No.9. The second part of Table 4 covers the finding on sustainable development goals. The highest mean of 4.16 conquered that the respondents believe that each one of us is an agent of change for successfully achieving 17 sustainable development goals followed by second highest mean score of 4.04 on aware of the strategies available to solve the environmental issues. Next, the item on the awareness of activities or initiatives conducted by local authority scored mean of 3.97 and the last item on participation in environmental activities by NGOs or the communities scored mean 3.92.

Table 4*Descriptive statistics for sub-topic 10.3: Green Technology and Environment and sub-topic 10.4: Sustainable Development Goals.*

Item	Mean Score	Standard Deviation
Sub-Topic 10.3		
I understand the importance of green technology as a solution towards achieving Sustainable Development Goal No.9 (Industry, Innovation and Infrastructure).	4.30	0.713
Sub-Topic 10.4		
I believe that everyone is an agent of change for achieving all 17 Sustainable Development Goals.	4.16	0.795
I know how to participate in environmental activities organised by NGOs or local communities	3.92	0.772
I am aware of the environmental initiatives organised by my local authority.	3.97	0.791
I am aware of the strategies required to resolve the environmental issues.	4.04	0.721
Average Mean Score Sub-Topic 10.4	4.02	

Overall analysis of Part I surveys of knowledge component in Table 5 showed that the lowest mean scored of 3.68 was related to questionnaires in sub-topic 10.5 on ecological footprint. This finding shows that the content of ecological footprint needs more attention to strengthen the concept and understanding of the area.

Table 5*Descriptive statistics for sub-topic 10.5: Ecological Footprint and You.*

Item	Mean Score	Standard Deviation
I can calculate my ecological footprint.	3.68	0.875

Table 6 tabulated findings on the six main components of the knowledge component based on the framework of assessment of environmental literacy by NAEE (2011). The average mean score has been calculated and ranked to reflect the overall first part of the survey.

Table 6

Findings of the knowledge component (cognitive domain) based on framework of assessment of environmental literacy (NAEE, 2011)

Dimension I	Component	Average Mean Score	Ranking
Knowledge (cognitive domain)	Physical and ecological systems	3.94	3
	Social, cultural and political systems	4.23	2
	Environmental issues	4.33	1
	Solutions to environmental issues	4.23	2
	Citizen/public participation	3.92	4
	Action strategies	3.86	5

Disposition

The questionnaire was distributed to 180 students who have participated in the first part of the study and only 39 responded to the second part of the research.

The second part of the research was to explore the levels of OUM students' disposition of environmental sustainability. Each disposition is summarised in the tables below.

Table 7 shows the mean and standard deviation score for the component of sensitivity. The item with the highest mean score is "I feel troubled when I see people conduct open burning" (M=4.69, SD=.731), and the lowest mean score is "I feel upset to know people cut trees" (M=4.18, SD=.854).

Table 7

Sensitivity

	N	Mean	Std. Deviation
I feel upset when I see people throw rubbish everywhere	39	4.51	.942
I feel troubled when I see people conduct open burning	39	4.69	.731
I feel upset when I read about air/water pollution	39	4.56	.754
I feel upset to know people cut trees	39	4.18	.854
I feel good attending events that do not use plastic bottle drink	39	4.23	.706
I feel good when I have practiced the 3Rs	39	4.44	.552
Average score		4.44	0.757

Table 8

Attitude, concern a worldview

	N	Mean	Std. Deviation
I am worried that the environment is getting worse each day	39	4.64	.537
I know that people in all countries are aware of the seriousness of environmental concerns	39	3.87	1.080
I think countries in the world should discuss and have common environmental policies	39	4.59	.637
I think the environmental issues should be one of the main issues in the world summit discussions	39	4.54	.643

	N	Mean	Std. Deviation
I think the society is very concerned about sustainability	39	3.92	.870
I think the society is supporting the 6Rs (Rethink, Refuse, Reduce, Reuse, Recycle, Replace)	39	3.97	1.013
Average score		4.26	.790

Table 8 shows the mean and standard deviation score for the component on attitude, concerns a worldview. The item with the highest mean score is “I am worried that the environment is getting worse each day” (M=4.64, SD=.537), and the lowest mean score is “I know that people in all countries are aware of the seriousness of environmental concerns” (M=3.87, SD=1.080).

Table 9*Personal responsibilities*

	N	Mean	Std. Deviation
I conserve energy and water whenever I can	39	4.31	.655
I teach my family members and friends on the importance of energy and water saving	39	4.28	.793
I have joined environmental-related activities	39	3.74	.818
I will ensure that I do not do anything that will harm the environment e.g. open burning rubbish, littering etc	39	4.26	.751
I will be car-pooled whenever it is possible	39	3.85	.709
I ensured that the usage of electricity and water usage do not reach certain levels	39	4.15	.779
Average score		4.10	.750

Table 9 shows the mean and standard deviation score for the component of personal responsibilities. The item with the highest mean score is “I conserve energy and water whenever I can” (M=4.31, SD=.655), and the lowest mean score is “I have joined environmental-related activities” (M=3.74, SD=.818).

Table 10*Self-efficacy/locus of control*

	N	Mean	Std. Deviation
I believe if I recycle, people will also do the same	39	4.05	.826
I know I have the opportunity to make the world a better place	39	4.38	.590
I believe I can teach people how to conserve water and energy	39	4.08	.703
I am confident that I can improve the environment	39	4.08	.664
I believe that I can change for the betterment of the environment	39	4.18	.644
I believe I can influence other people to sustain the environment	39	4.05	.826
Average score		4.13	.708

Table 10 shows the mean and standard deviation score for the component of self-efficacy/locus of control. The item with the highest mean score is “I know I have the opportunity to make the world a better place” (M=4.38, SD=.590) and there are two items with the lowest mean score which are “I believe if I recycle, people will also do the same” (M=4.05, SD=.826); and “I believe I can influence other people to sustain the environment” (M=4.05, SD=.826)

Table 11

Motivation

	N	Mean	Std. Deviation
I always adopt reusable bag practices	39	4.28	.647
I always reuse and recycle	39	4.28	.724
I decrease meat consumption	39	3.67	.806
I do not purchase aerosol sprays	39	3.69	.977
I am eager to learn more about the sustainability	39	4.13	.732
I have been reading a lot of books about environmental-related issues	39	3.97	.843
Average score		4.01	.788

Table 11 shows the mean and standard deviation score for the component of motivation. The item with the highest mean score is “I always adopt reusable bag practices” (M=4.28, SD=.647), and the lowest mean score is “I decrease meat consumption” (M=3.67, SD=.806).

Table 12

Intention

	N	Mean	Std. Deviation
I always intend to be involved in environmental projects	39	3.87	.894
I always wanted to join community service	39	4.03	.778
I have the intention to attend talks and seminars about the environment	39	3.90	.788
I want to learn more about how to sustain the environment in a more proper way	39	4.13	.695
I will start to practice the 6R at home	39	4.13	.615
I wish to be a good influencer to others pertaining to environmental issues	39	3.87	.801
Average score	39	3.99	.762

Table 12 shows the mean and standard deviation score for the component of motivation. The item with the highest mean score is “I want to learn more how to sustain the environment in a more proper way” (M=4.13, SD=.695), and the lowest mean score is “I always intend to be involved in environmental projects” (M=3.87, SD=.894).

Table 13 shows the summary of the dispositions of environmental sustainability.

Table 13

Descriptive Statistics

	Mean	Std. Deviation	N
Sensitivity	4.44	.757	39
Attitude	4.26	.790	39
Personal responsibility	4.10	.750	39
Self-efficacy	4.13	.708	39
Motivation	4.01	.788	39
Intention	3.99	.762	39

The table shows that students have the highest level of sensitivity towards environmental concerns (M=4.44, SD=.757), while the lowest score is the intention to be involved in environmental projects (M=3.99, SD=.762). This shows that although students

are sensitive about what is happening to their environment, they do not have a high intention to be part of any environmental projects.

Discussion

The first part of the study analyses the content of Topic 10 The Environment and Us and the respondents were from the first semester of undergraduate programmes taking the course on Learning Skills for 21st Century. A small percentage of only 8.7% respondents were recorded and analysed. In summary, Table 16 shows data where the overall mean average scores are acceptable between the lowest 3.68 to the highest mean score 4.33. The lowest being the last sub-topic of 10.5 titled Ecological Footprint and You. In taking remedial action based on the analysis, the content of Topic 10 has been revised in which additional content of sub-topic 10.5 to strengthen the understanding of the ecological footprint. Activities and additional websites were added to support the learners in the area of the ecological footprint. The findings prove that in the effort to create environmentally literate adults, formal environmental education is necessary and must be embedded in the university programmes. This is to show that the environmental knowledge is crucial because without the basic knowledge of the environment one may not be able to make a sound judgement and actions towards the environmental issues (Liu and Yeh, 2015).

Table 16

Summary of analysis mean score sub-topics in Topic 10 (The Environment and Us)

No	Item	Mean Average Scores
1	Sub-topic 10.1: Why should we care about the environment?	4.04
2	Sub-topic 10.2: Global Environmental Issues	4.33
3	Sub-topic 10.3: Green Technology and Environment	4.30
4	Sub-topic 10.4: Sustainable Development Goal	4.02
5	Sub-topic 10.5: Ecological Footprint and You	3.68

In this study, the framework of assessment of environmental literacy proposed by NAAEE in 2011 was adopted. Table 6 summarised the first dimension of environmental literacy, knowledge based on the framework. All six components were ranked based on the average mean score. The first ranked was environmental issues, second ranked came up with two components which were social, cultural and political systems and solutions to environmental issues. Third ranked was the physical and ecology systems followed by the fourth ranked which was citizen/public participation. Both the sub-topics had items with rating less than 4; and could be improved further. Fifth ranked the lowest was the action strategies. Overall, the average mean components range between 3.86 to 4.33.

The above ranking was used to improve the content of the module and to prepare additional learning materials. The rating for environmental issues is indeed positive, as this is the component that is foreseen to subsequently create a change in learners' attitude and dispositions at large. Realisation of the state of environmental problems may create environmentally literate individuals who through the understanding of the social, cultural and political systems and the solutions to environmental issues could perhaps increase their capabilities to influence and possibility find practical solutions to resolve pressing environment issues. The third rank and the fourth rank on physical and ecological systems and on citizen/public participation require further attention. It is important for learners to comprehend the intricate relationship between natural systems and events that occur on earth, particularly in improving decision making and strategies that are proposed to resolve increasing critical environmental issues such as the climate change. Equally important is the understanding of public participation through environmental activities at community, local

authorities or NGOs level. The final sub-topic is centred more towards individual responsibilities and action towards improving their own carbon footprint. Additional materials that have developed as an outcome of this finding is focused on individual action strategies. The assignment embedded in the course requires the use of 21st century skills and knowledge on global citizenship education that the learners are exposed to through nine other topics in the course. The assignment requires direct involvement of the learners to resolve current issues impacting the environment. Further efforts to strengthen the learning materials as well as create embedded curriculum as suggested by Liang et al. (2018) are being explored.

The second part of the study examines the levels of dispositions of environmental sustainability among OUM students and its relationship with their learning experience of the course, specifically Topic 10. The relationship between students' learning experience and their willingness to volunteer in environmental projects was also surveyed. The dispositions dimensions studied were sensitivity attitudes, personal responsibilities, self-efficacy, motivation, and intention. The results show that all the components of dispositions have a high mean score, which is between 3.61 and 5.0. This is in congruent with the study by Cabuk and Karacaoglu (2003), who mentioned that a person is willing to make positive attempts against environmental issues. Students also responded positively concerning the environment and its significance (Hines et al., 1987). Furthermore, high personal responsibility towards the environment shows that individuals are willing to demand accountability for their behaviours and the consequences (Bennet, 2017; Mergler & Shield, 2016). High score for self-efficacy also shows that students believed that they could bring about the change in the environment (Kollmuss & Agyeman, 2002). Meanwhile, students showing a high mean score in motivation indicate their willingness to invest their effort to ensure that the environment remains sustainable. (Matsumoto, 2009). The intention of students to sustain the environment shows that they have environmental responsibility behaviour (Brönmark & Hansson, 2002). Unfortunately, students scored the lowest in their intention to sustain the environment (3.99). This is aligned with the study by Kollmuss and Agyeman (2002), who found that people are perfectly willing to change their behaviour but still not do so, because they do not persist in practicing the new behaviour until it becomes a habit.

Conclusion

The assessment environmental literacy framework adopted by Hollweg et al. (2011) used in this study showed a good assessment tool to assess both the level of knowledge of environmental sustainability and the level of disposition of environmental sustainability among OUM students. The first research objective which is the level of knowledge of the OUM students were proven to be high ranging from average mean score 3.86 to 4.33. The environmental issues component ranked first and the last ranked was the action strategies. The action has been taken by revising the learning materials (Topic 10) to improve the content of the last sub-topic 10.5 Ecological Footprint and You. The findings have proven that in the effort to create environmentally literate adults, formal environmental education is necessary. The environmental knowledge is crucial as without the basic knowledge of the environment, one may not be able to make a sound judgement and decision towards the environmental issues. The second research objective which is the level of dispositions of environmental sustainability among OUM students showed that all the components of dispositions have a high mean score, which is between 3.61 and 5.00. An effective way to increase environmental awareness among OUM adult learners is through the formal education and designing practical assignments.

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References

- Altin, A., Tecer, S., Tecer, L., Altin, S., & Kahraman, B. F. (2014). Environmental awareness level of secondary school students: a case study in Balıkesir (Türkiye). *Procedia - Social and Behavioral Sciences*, 141, 1208-1214.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prantice-Hall.
- Brönmark, C., & Hansson, L. A. (2002). Environmental issues in lakes and ponds: Current state and perspectives. *Journal Environmental Conservation*, 29(3), 290–307. doi: <https://doi.org/10.1017/S0376892902000218>
- Cabuk, B., & Karacaoglu, C. (2003). Investigation of university students' environmental sensitivity, ankara university. *Journal of Faculty of Educational Sciences*, 36, 1-2.
- Eagly, A. H., & Chaiken, S. (1993). *The psychology of attitudes*. Harcourt Brace Jovanovich.
- Fettahlioğlu, P., Timur, S., & Timur, B. (2016). Environmental Affective Dispositions Scale (EADS): The Study of Validity and Reliability and Adaptation to Turkish. *International Journal of Environmental & Science Education*, 11(10), 3179–3199.
- Gunduz, T. (1998). *Cevresorunları [Environmental Problems]*. GaziKitabevi.
- Hassan, A., Noordin, T. A., & Sulaiman, S. (2010). The status on the level of environmental awareness in the concept of sustainable development amongst secondary school students. *Procedia - Social and Behavioral Sciences*, 2(2), 1276-1280.
- Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1987). Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. *Journal of Environmental Education*, 18(2), 1–8.
- Hollweg, K. S., Taylor, J. R., Bybee, R. W., Marcinkowski, T. J., McBeth, W. C., & Zoido, P. (2011). *Developing a framework for assessing environmental literacy*. North American Association for Environmental Education. <https://cdn.naaee.org/sites/default/files/devframewkassessenvlitonlineed.pdf>
- Hungerford, H. R., Peyton, R. B., & Wilkey, R.J. (1980). Goals for curriculum development in environmental education. *The Journal of Environmental Education*, 11(3), 42-47.
- Iman, F, Miarsyah, M, & Sigit, D. V. (2019). The effect of intention to act and knowledge of environmental issues on environmental behaviour. *Jurnal Pendidikan Biologi Indonesia*, 5(3), 529-536. doi: 10.22219/jpbi.v5i3.8842

- Joshi, Y., & Rahman, Z. (2015). Factors affecting green purchase behaviour and future research directions. *International Strategic Management Review*, 3. Holy Spirit University of Kaslik. doi: <https://doi.org/10.1016/j.ism.2015.04.001>
- Kaiser, F.G., S. Wölfing, & Fuhrer, U. (1999). Environmental attitude and ecological behaviour. *Journal of Environmental Psychology*, 19, 1–19.
- Karatekin, K. (2014). Social studies pre-service teachers' awareness of solid waste and recycling. *Procedia - Social and Behavioral Sciences*, 116, 1797-1801.
- Kollmuss, A., & Agyeman, J. (2002). Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, 8(3), 239-260. doi:10.1080/13504620220145401
- Liang, S., Fang, W., Yeh, S., & Liu, S. (2018). A nationwide survey evaluating the environmental literacy of undergraduate students in Taiwan. *Sustainability*, 10, 1730. <https://doi.org/10.3390/su10061730>
- Liu, S. C., & Lin, H. (2015). Exploring undergraduate students' mental models of the environment: Are they related to environmental affect and behavior? *The Journal of Environmental Education*, 46(1), 23-40
- Liu, S., & Yeh, S. (2015). A national investigation of teachers' environmental literacy as a reference for promoting environmental education in Taiwan. *The Journal of Environmental Education*, 46(2), 114–132. <https://doi.org/10.1080/00958964.2014.999742>
- Manstead, A. S. R. (2018). The psychology of social class: How socioeconomic status impacts thought, feelings, and behaviour. *British Journal of Social Psychology*, 57(2), 267–291. doi: <https://doi.org/10.1111/bjso.12251>
- Matsumoto, D. (2009). *The Cambridge dictionary of psychology*. Cambridge University Press.
- Measham, T. G., & Barnett, G. B. (2008). Environmental Volunteering: Motivations, modes and outcomes. *Australian Geographer*, 39(4), 537-552. doi:10.1080/00049180802419237
- Mergler, A. (2008). *Personal responsibility: The creation, implementation and evaluation of a school-based program* [PhD Thesis Queensland University of Technology]. <https://eprints.qut.edu.au/16382/>
- Mergler, A., & Patton, W. (2007). Adolescents talking about personal responsibility. *Journal of Student Wellbeing*, 1(1), 57–70. doi: <https://doi.org/10.21913/JSW.v1i1.113>
- Mergler, A., & Shield, P. (2016). Development of the personal responsibility scale for adolescents. *Journal of Adolescence*, 51, 50–57. doi: <https://doi.org/10.1016/j.adolescence.2016.05.011>
- Ministry of Energy, Science, Technology, Environment and Climate Change (2018). Malaysia's roadmap towards zero single-use-plastics 2018-2030.
- Ministry of Natural Resources and the Environment, in collaboration with Universiti Teknologi Malaysia (UTM). (2012). Environmental performance index for Malaysia 2012

- Neo, S. M., Choong, W. W., & Ahamad, R. (2016). Environmental awareness and behaviour index for Malaysia. *Procedia - Social and Behavioral Sciences*, 222(07), 668–675. <https://doi.org/10.1016/j.sbspro.2016.05.223>
- OECD. (2010). *PISA 2009: Assessment Framework: Key Competencies in reading, mathematics and science*. Paris, France.
- Ozdemir, A., Aydin, N., & Akar-Vural, R. (2009). A scale development study on self-efficacy beliefs through environmental education. *Dokuz Eylül Üniversitesi Buca Eğitim Fakültesi Dergisi*, 26, 1-8
- Pan, S., Chou, J., Morrison, A. M., & Lin, M. (2018). Will the future be greener? The environmental behavioral intentions of university tourism students. *Sustainability*, 10(634), 1–17. doi: <https://doi.org/10.3390/su10030634>
- Pickard, H. (2014). Responsibility without blame: Therapy, philosophy, law. *Prison Service Journal*, 213, 10–16. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4430804/>
- Pintrich, P. R., & Schunk, D. H. (2002). *Motivation in education: Theory, research and applications*. Prentice Hall Merrill
- Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs*, 80(609).
- Ryan, M. R. and Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, 25(1), 54-67. <http://dx.doi.org/10.1006/ceps.1999.1020>
- Shafii, N. Z., Saudi, A. S. M., Pang, J. C., Abu, I. F., Sapawe, N., Kamarudin, M. K. A., & Saudi, H. F. M. (2019). Application of chemometrics techniques to solve environmental issues in Malaysia. *Heliyon*, 5(10). doi: <https://doi.org/10.1016/j.heliyon.2019.e02534>
- Sward, L. L., & Marcinkowski, T. (2001). Environmental sensitivity; A review of the research, 1980- 1998. In H. Hungerford, W. Bluhm, T. Volk and J Ramsey (Eds.), *Essential Readings in Environmental Education* (pp. 277-288). Stipes Publishing, L.L.C.
- Uitto, A., K., Juuti, Lavonen, J., & Meisalo, V. (2004). Who is responsible for sustainable development? Attitudes to environmental challenges of Finnish 9th grade comprehensive school boys and girls. In A. Laine, J. Lavonen, & V. Meisalo (Eds), *Current Research On Mathematics And Science Education: Proceedings of the XXI annual symposium of The Finnish Association of Mathematics and Science Education Research*, (pp. 80–102). Research Reports of the Department of Applied Sciences of Education 253. University of Helsinki.
- United Nations Educational, Scientific and Cultural Organization. (1978). *The Tbilisi Declaration: Final report intergovernmental conference on environmental education*. Organized by UNESCO in corporation with UNEP. http://www.gdrc.org/uem/ee/EE-Tbilisi_1977.pdf
- UNESCO. (1978a). *Final report: Intergovernmental conference on environmental education*. UNESCO.
- UNESCO. (1978b, January). The Tbilisi Declaration. *Connect UNESCO/UNEP Environmental Education Newsletter*, 3(1), 1–8.

UNESCO. (1992, June). Agenda 21", *Connect. UNESCO/UNEP Environmental Education Newsletter*, 17(2), 3–7.

United Nation. (2015). *Sustainable development goals*.
<https://sustainabledevelopment.un.org/sdg4>

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). doi: [https://doi.org/ 10.1080/0950069042000177280](https://doi.org/10.1080/0950069042000177280)