

## IMPACT OF SUSTAINABLE DEVELOPMENT EDUCATION AT UNIVERSITI TEKNOLOGI MALAYSIA (UTM)

SAMANEH ZOLFAGHARIAN<sup>1\*</sup>, MEHDI NOURBAKHSH<sup>2</sup>,  
JAVIER IRIZARRY<sup>3</sup>, MASOUD GHEISARI<sup>4</sup> & ROZANA  
ZAKARIA<sup>5</sup>

**Abstract** The aim of this paper is to investigate the effects of education and training on promoting knowledge of sustainable living and engineering. This study was carried out during a sustainability workshop, which aimed to encourage students to cooperate in developing Universiti Teknologi Malaysia (UTM) as a sustainable campus. The data was collected through a survey to measure the level of knowledge and awareness of the students before and after attending the workshop. The collected data was evaluated based on the Kirkpatrick method and its levels of assessments namely attendance satisfaction and learning. The results showed significant differences on students' knowledge, awareness, and attitudes toward sustainable living prior and after the course.

*Keywords:* Education; sustainable development; environmental awareness; sustainability; sustainable training

### 1.0 INTRODUCTION

Sustainability has been defined as “meeting the needs of the present generation without compromising the ability of future generations to meet their own needs” (UNESCO, 2000; Heyn, 1997; McClaren, 1993). Sustainable development is based on principles of interaction between society and nature that lead to

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<sup>1&2</sup> MSc Student, Dept. of Structures and Materials, Faculty of Civil Engineering, Universiti Teknologi Malaysia, Johor, Malaysia

<sup>3</sup> Assistant Professor, School of Building Construction, Georgia Institute of Technology, Atlanta, USA

<sup>4</sup> PhD. Candidate, School of Building Construction, Georgia Institute of Technology, Atlanta, USA

<sup>5</sup> Senior Lecturer, Dept. of Structures & Materials, Faculty of Civil Engineering, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia.

\* Corresponding author: [zsamaneh2@live.utm.my](mailto:zsamaneh2@live.utm.my)

harmonization of economic and social development with protection and preservation of the environment (Pidlisnyuk *et al.*, 2010). One of the requirements to implement sustainable development is the knowledge and understanding on environmental issues (Gao *et al.*, 2006). There is however, a significant lack of awareness of the interrelated nature of all human activities with sustainable development among societies to participate in sustainable development (Agenda 21). Thus, existence of environmental awareness and educational training is important to improve the knowledge and skills of human to collaborate in environmental protection and sustainable development. Such awareness and education provide the essential tools and understanding to affect societies to make environmentally responsible decisions (Hale, 1995; Madsen, 2001). To address the barriers of sustainable development, implementation of an appropriate education and training system needs to be considered (Sunil Heart, 2000).

Sustainable development education and training programs require significant investment (James, 1996). Significant economic resources have been used for addressing environmental issues (Worthen, 2001). Meanwhile, companies, as investors, need to assess the outcomes and success of their training efforts to ensure that the environmental training is able to produce the essential information and change in attitude of employees with regard to the sustainable development (Martin, 2001). Therefore, there should be a systematic evaluation of such efforts in order to assess the impact of training programs in transferring information to participants (Martin, 2001). The aim of this study is to assess the impact of education in sustainable development as a learning procedure. This research begins to outline the needs and benefits of environmental education and awareness then, it investigates the impact of a workshop about sustainable living education and awareness.

## **2.0 SUSTAINABLE EDUCATION AND AWARENESS**

The social properties of organizations involve employees' thinking, feelings, and activities (McShane, 2001). The employee participation has been identified as a main source of ingenuity, knowledge, and expertise for an organization (Wehrmeyer, 1996; James, 1996). Based on North (1996)'s point of view, successful environmental performance depends on the utilization of knowledge in organizations. The knowledge, activities, and decisions of the all members in an

organization influence sustainable development efforts. Thus, all participants in organizations should be aware of how they may cooperate to achieve a sustainable environment in their organization (Perron *et al.*, 2006). Employee's understanding allows them to take part in sustainable development efforts and effect continuous performance improvements.

(ESD) is a dynamic concept that encompasses a new vision of education that seeks to empower people of all ages to assume responsibility for creating and enjoying a sustainable future.

Education for Sustainable Development (ESD) is a dynamic concept to encourage people of all ages to create and enjoy a sustainable future (Khataybeha, 2010). The ESD motivates employees to operate for optimistic environmental and social conversions to achieve a better realization of their world. The most consequential advantages of the application of ESD in organizations are such as, enhancing capability to retain qualified employees; improving motivation of staff; increasing the ability to engage high achieving graduates; improving status that comes from working for a company that shows care for the environment; and making a feeling of ownership among employees towards the success of the company (Hui IK *et al.*, 2001; Cramer *et al.*, 1993; North & Daig, 1996; Schneider B, 1985; Reinhardt FL., 2000). Environmental education and training encourage employees to participate in the environmental initiatives (Cook, 1992). Moreover, training and education are important elements in prompting employees to understand their responsibilities in executing sustainable development (National Round Table on the Economy and the Environment, 1991). Therefore, companies must prepare environmental awareness education and training programs that provide the necessary information to their employees (Hale, 1995; Cohen, 2000). On the other hand, all employees require this information to make correct decisions and select suitable actions toward distinguishing environmental issues and conditions (Duck, 1993; Bansal, 1997). Thus, a vital aspect of effecting change in employees' behavior and attitudes are environmental education and awareness training programs because the sustainable development success has not yet been universal (Perron *et al.*, 2006).

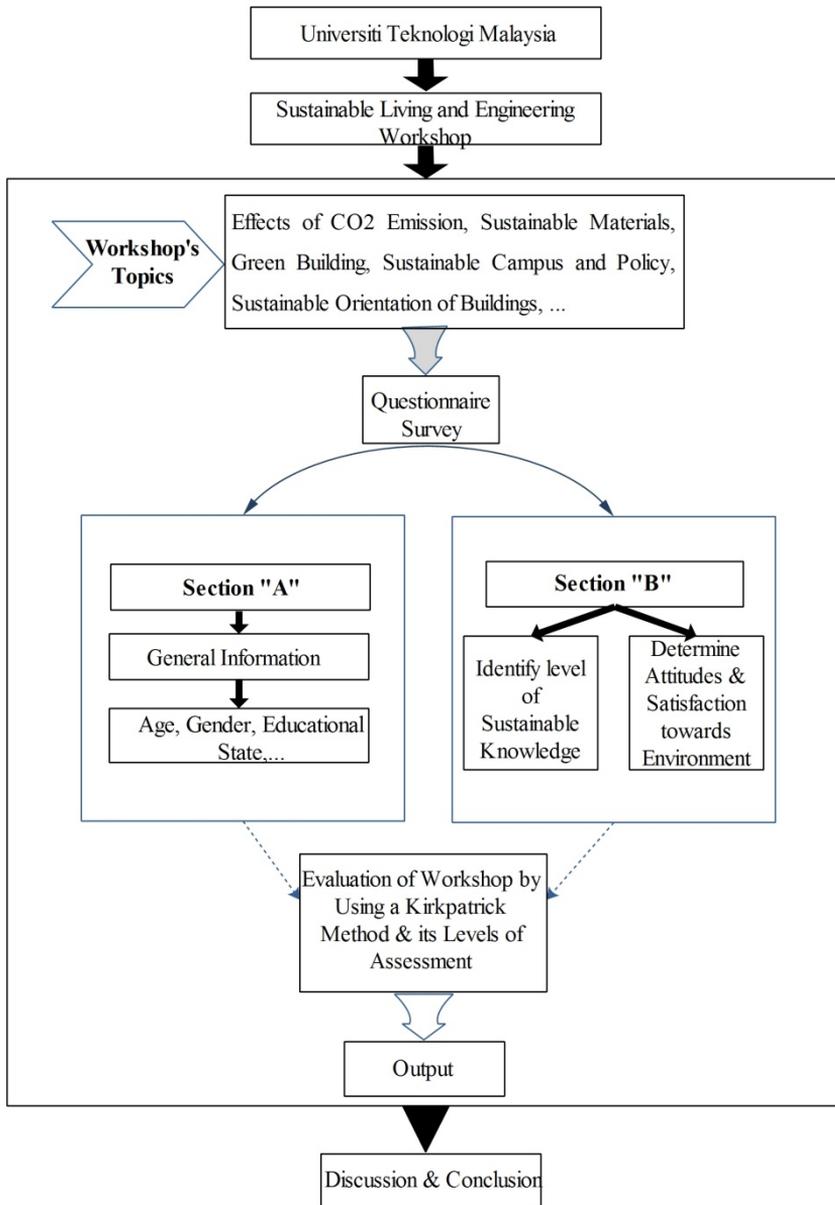
### 3.0 RESEARCH DESIGN

This study was carried out during a workshop titled “Sustainable Living and Engineering” at Universiti Teknologi Malaysia (UTM). This workshop aimed to enhance students’ knowledge on the importance of protecting and preserving the environment. This program also intended to motivate students to proceed toward developing a sustainable campus at UTM. The workshop training was performed within sustainability week in November 2010. The main topics of this workshop are shown in Table 1.

**Table 1** Main topics and contents of the workshop

Item	Topics	Item	Topics
Q1	Global Warming	Q 11	The Eco- House
Q 2	Effects of CO2 Emissions	Q 12	Eco-specifier and Green Materials
Q 3	What is sustainable development?	Q 13	Green Building
Q 4	The Ecological Footprint	Q 14	How does a green building index work?
Q 5	Construction & Sustainable Policy	Q 15	Why we need a sustainable campus.
Q 6	Why we need sustainable buildings.	Q 16	Sustainable Campus and Policy
Q 7	Sustainable Materials	Q 17	Recycle, Reuse and Reduce on Campus
Q 8	Embodied Energy	Q 18	How to turn our campus to a green campus?
Q 9	Sustainable Orientation of Buildings	Q 19	Energy Efficiency on Campus
Q 10	What is Passive Building Design?		

Figure 1 illustrates the process of this study. A questionnaire survey was conducted to assess the respondents’ level of knowledge before and after the workshop. The collected data were analyzed and the results were discussed.



**Figure 1** Schematic of research methodology

In this study, stratified random sampling technique has been used in which the population has divided into two groups, namely undergraduate and postgraduate

students. Out of 300 students, in the workshop, questionnaires are distributed randomly among one hundred students at the entrance of the workshop. They were asked to fill out the questionnaire that consisted of 35 questions at the start of the first session and then at the end of the last session of the workshop. In this questionnaire, a Likert scale was used to indicate the magnitude of their responses (1 = “not at all aware” to 5 = “extremely aware”; and 1 = “strongly disagree” to 5 = “strongly agree”). Table 2 illustrates sample questions from the questionnaire.

**Table 2** Sample questions from different sections in the questionnaire

Question Section		Sample Questions
Sustainable Living and Engineers' Knowledge		<ul style="list-style-type: none"> <li>• Indicate the level of your knowledge and awareness for each topic, before and after attendance in workshop (Q1-Q19). (Not at all Aware, Slightly Aware, Somewhat Aware, Moderately Aware, Extremely Aware):</li> <li>• Q1) Global Warming</li> <li>• Q2) Effects of CO2 Emission</li> <li>• Q3) What is sustainable development?</li> </ul>
Sustainable Living and Environmental attitudes	Attitude	<ul style="list-style-type: none"> <li>• I am going to persuade my friends and family to care more about the environment. (Strongly Disagree, Disagree, To Some Extend, Agree, Strongly Agree)</li> <li>• I am going to change my behavior to become more environmentally responsible. (Strongly Disagree, Disagree, To Some Extend, Agree, Strongly Agree)</li> </ul>
	Training	<ul style="list-style-type: none"> <li>• This workshop has contributed to my understanding of environmental issues. (Strongly Disagree, Disagree, To Some Extend, Agree, Strongly Agree)</li> <li>• I feel more responsible toward the environment after participating in this workshop. (Strongly Disagree, Disagree, To Some Extend, Agree, Strongly Agree)</li> <li>• I feel this workshop improved my quality of life. (Strongly Disagree, Disagree, To Some Extend, Agree, Strongly Agree)</li> </ul>
	Satisfaction	<ul style="list-style-type: none"> <li>• I would recommend UTM to others because UTM cares about environmental issues. (Strongly Disagree, Disagree, To Some Extend, Agree, Strongly Agree)</li> <li>• I feel better about UTM after attending this workshop. (Strongly Disagree, Disagree, To Some Extend, Agree, Strongly Agree)</li> </ul>

In the first part of the questionnaire, section “A”, the general information of respondents including their gender and age are solicited. In the next sections, section “B”, the respondents were required to indicate the level of sustainable knowledge and awareness in the domain of sustainable living and engineering before and after attending the workshop, and also identifying their attitudes towards the environment. Data gathered from the survey were analyzed quantitatively using a paired t-test.

The main instrument evaluation steps used were based on Kirkpatrick’s method (Kirkpatrick, 1994) and its levels of assessment. Although there are several techniques to evaluate training programs such as Time Series Analysis (Bakken & Bernstein, 1982), 3-Test method (Rae, 1983), Protocol Analysis (Mmobuosi, 1985), and pre\_then\_post Testing (Mezoff, 1981), the Kirkpatrick’s method is the most popular approach for evaluation of training programs (Bates, 2004). Due to its ability to simplify the complex process of training evaluation by reducing the number of evaluation variables and providing effective guide about the questions that should be asked (Bates, 2004).

**Table 3** Kirkpatrick’s model of evaluation

	<b>Levels’ Name</b>	<b>Time of the Evaluation</b>
<b>Level 1</b>	Reaction / Customer Satisfaction	During/ End of the Program
<b>Level 2</b>	Learning	Before/ End of the Program
<b>Level 3</b>	Behavior	End of/ Few months after the Program
<b>Level 4</b>	Result	Few months after the Program

Kirkpatrick (1994) proposed four levels for evaluating training programs (Table 3). The first level is reaction or customer satisfaction. It is extremely important to assess customer’s satisfaction, not only because the program depends on customers, but also favorable reaction motivates trainees to learn. The second level is learning, which means changing attitudes, improving knowledge, and/or increasing skill as a consequence of attending the program. Likewise, learning will occur if knowledge is augmented, attitude is changed or skill is enhanced. The

next two levels are behavior and result. Behavior can be defined as a change in participants' attitude as a result of attending the program. The result is also the outcome of the program.

By going from one level to the next, the training evaluation will be more difficult and time consuming. The first level of evaluation could be performed during or/and at the end of the program. This means that Customer Satisfaction can be evaluated during the program or/and at the end of the program by interview, questionnaire, and etc.; the second level would be carried out before the program or/and at the end of the program. Similarly, the third level could be done at the end of program and/or few months after the program. Finally, the fourth level could be done after a few months (normally two or three months) (Kirkpatrick DL., 1994). Because of the nature of the studied workshop and the difficulty of contacting the students after a few months, this study focused on the first two levels as it was applicable in such workshops.

To implement the Kirkpatrick method, the questionnaire is designed based on two main sections. The aim of the first section (question 1 to 19) is to investigate the level of knowledge and awareness of participants (Level 2 of Kirkpatrick method). Similarly, section two of the survey aimed at determining the attendants' satisfaction (Level 1 of Kirkpatrick method) as well as effects of workshop and their attitude toward the environment.

#### **4.0 RESULTS AND DISCUSSION**

The survey received 57% (n=100) response rate. Of the 57 respondents 56% are male and 44% female and also 65% undergraduate students and 35% graduate students (n=57). In order to investigate the reliability of the Likert scale, the Cronbach's alpha coefficient was used. The alpha coefficient that is more than 0.7 is considered as a reliable scale (Pallant, 2001). In this study, the alpha coefficient represents highly interrelated data ( $0.915 > 0.7$ ) and consistency of the scale with sample size. The results of the survey are presented in the following sections.

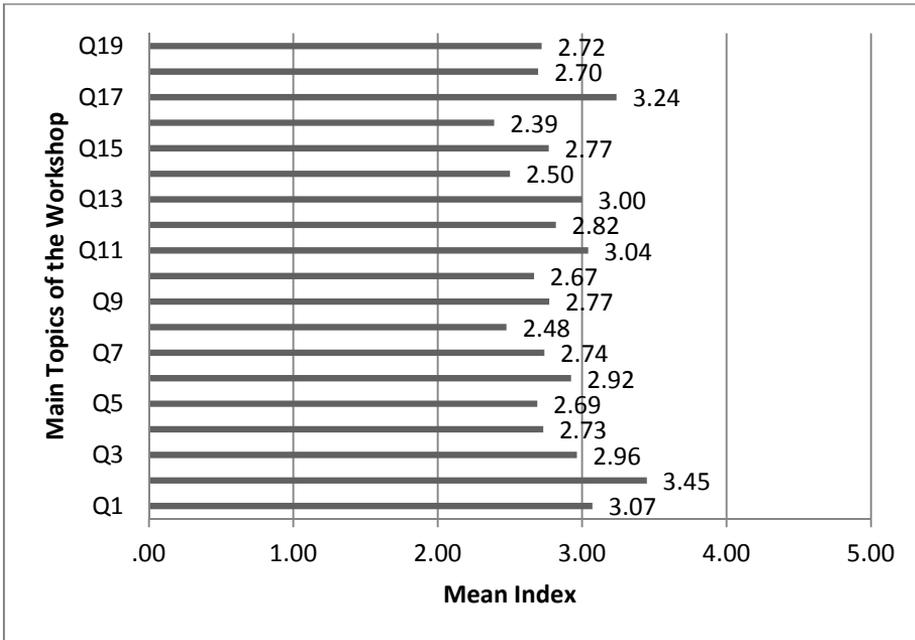
#### 4.1 Level of Knowledge and Awareness before the Workshop

The basic level of knowledge and awareness of participants was investigated through nineteen Likert scale questions. Table 4 shows the classification of the mean scores was adopted from Abd. Majid & McCaffer (1997).

**Table 4** Classification of mean index adopted from Abd. Majid & MacCaffer (1997)

Mean range	Description
$1.00 \leq \text{Mean Score} < 1.50$	“Not at all Aware”
$1.50 \leq \text{Mean Score} < 2.50$	“Slightly Aware”
$2.50 \leq \text{Mean Score} < 3.50$	“Somewhat Aware”
$3.50 \leq \text{Mean Score} < 4.50$	“Moderately Aware”
$4.50 \leq \text{Mean Score} < 5.00$	“Extremely Aware”

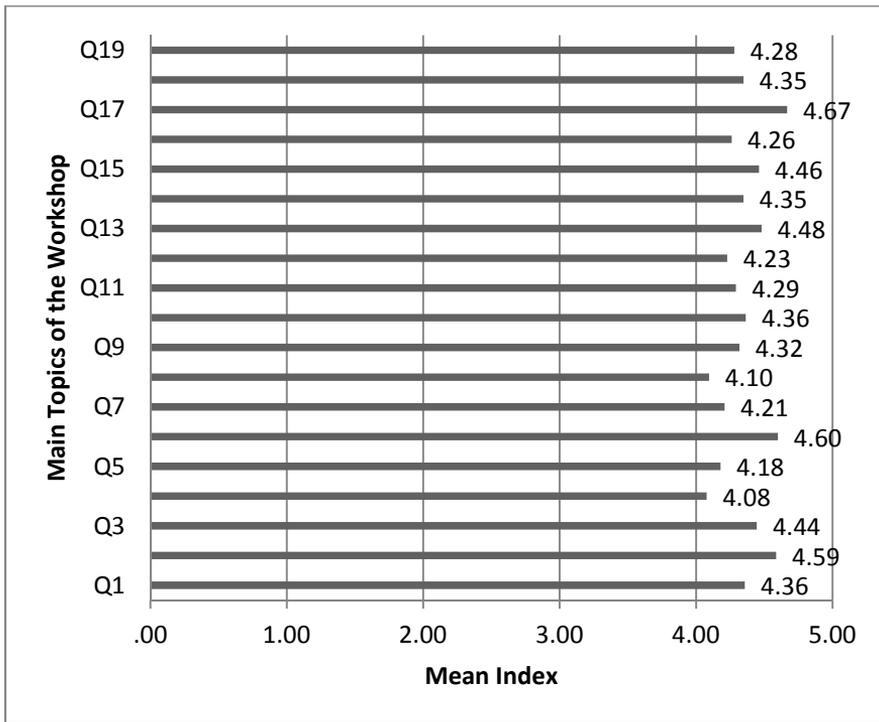
Figure 2 illustrates the level of participants' awareness of conference topics before attending the workshop. It can be clearly seen that the participants were “Somewhat Aware” of most of the workshop topics ( $2.5 \leq \text{mean score} < 3.5$ ). Although, the “Effect of Co2 Emission” and “Recycle, Reuse and Reduce on Campus” are two categories that participants were aware more than other topics, “Embodied Energy”, “How does a green building index work?”, and “Sustainable Campus and Policy” were three topics which were less familiar for attendees.



**Figure 2** Level of knowledge and awareness of the participants about conference topics before the workshop

## 4.2 Level of Knowledge and Awareness after the Workshop

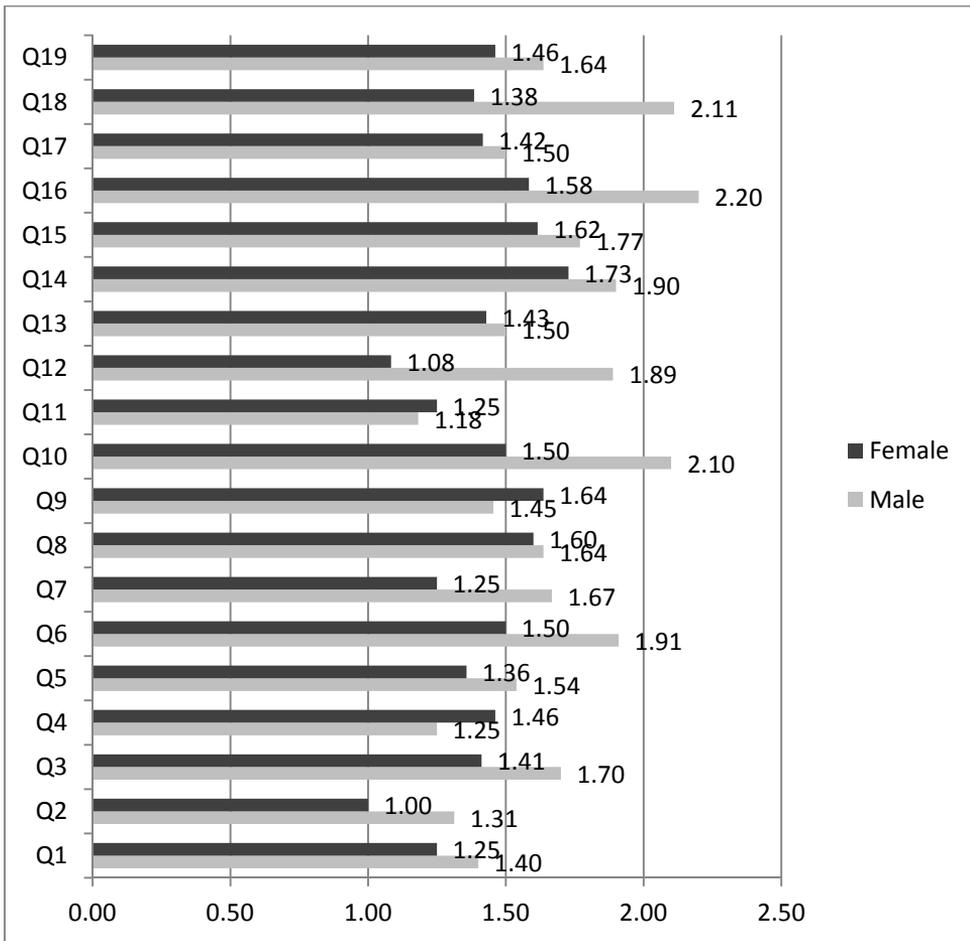
The same 19 questions were asked at the end of last session of the workshop to evaluate the level of awareness and knowledge of the participants. Figure 3 illustrates the results of the survey. Based on the Figure 3, most of the participants became “Aware” of the concepts of the topics ( $3.5 \leq \text{mean score} < 4.5$ ). In addition, in three topics, namely “Effects of CO<sub>2</sub> Emission”, “Why we need sustainable building?”, and “Recycle, Reuse and Reduce in Campus”, the students became “Extremely Aware” since their mean scores are between 4.5 and 5.



**Figure 3** Level of knowledge and awareness of the participants after the workshop

### 4.3 Comparison the Impact of the Workshop based on Gender

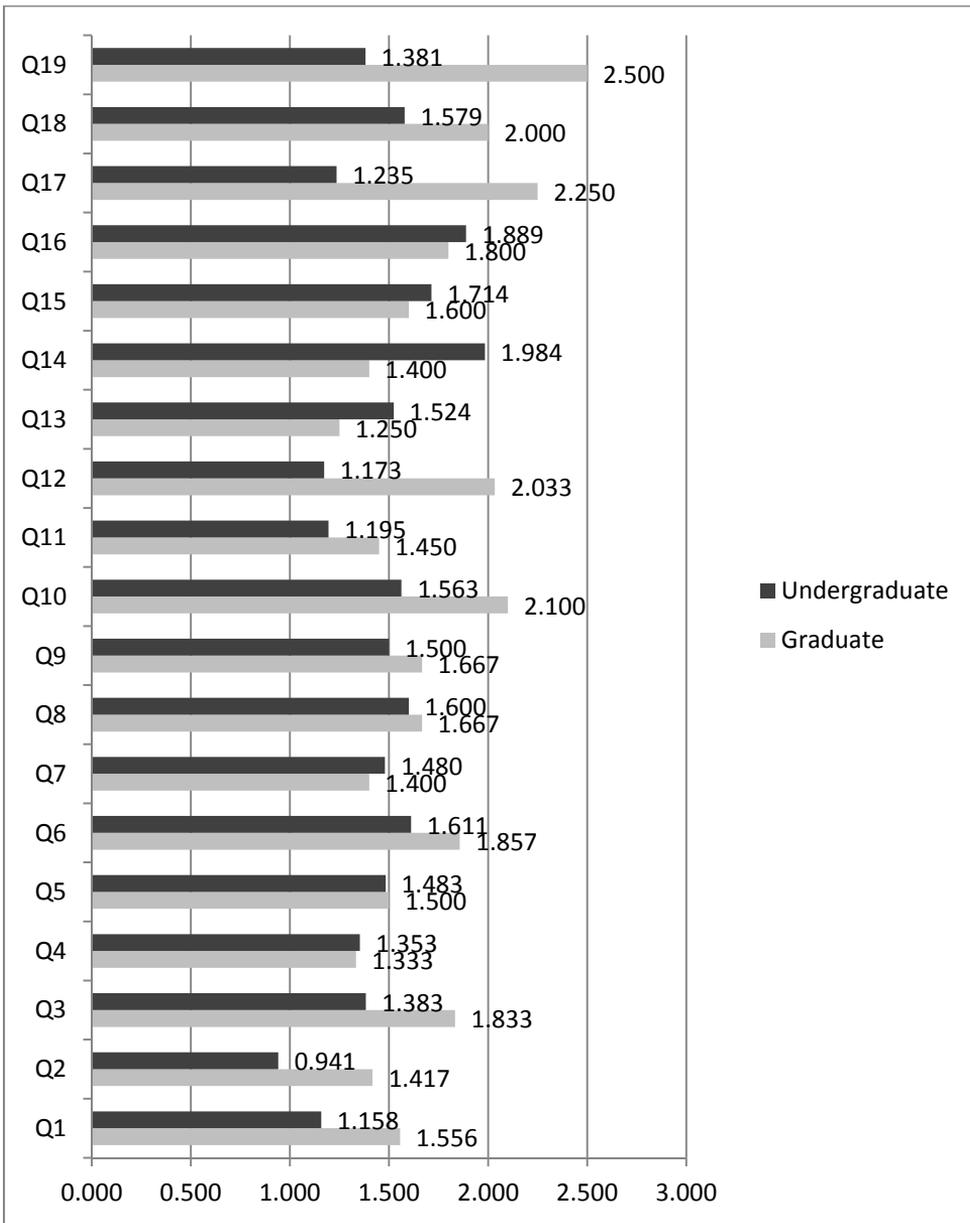
The impact of the workshop on male and female participants was investigated by comparing their mean scores. Figure 4 shows the results based on gender. Overall, acquisition of knowledge is greater for men compared women, except the concepts of Q4 (“The Ecological Footprint”), Q9 (“Sustainable Orientation of Buildings”) and Q11 (“The Eco- House”) in which the difference in mean scores for women is more than for men.



**Figure 4** Comparison of the participants' responses based on gender

#### 4.4 Comparison the Impact of the Workshop based on Level of Study

Figure 5 illustrates the impact of workshop between undergraduate and graduate students. Generally, the increase in mean scores is higher for graduate students than undergraduate students, excluding concepts of Q4 ("The Ecological Footprint"), Q7 ("Sustainable Materials"), Q13 ("Green Building"), Q14 ("How does a green building index work?"), Q15 ("Why we need a sustainable campus."), and Q16 ("Sustainable Campus and Policy") for which the difference in mean scores for undergraduate students is greater than for graduate students.



**Figure 5** Comparison of the participants' responses based on level of study

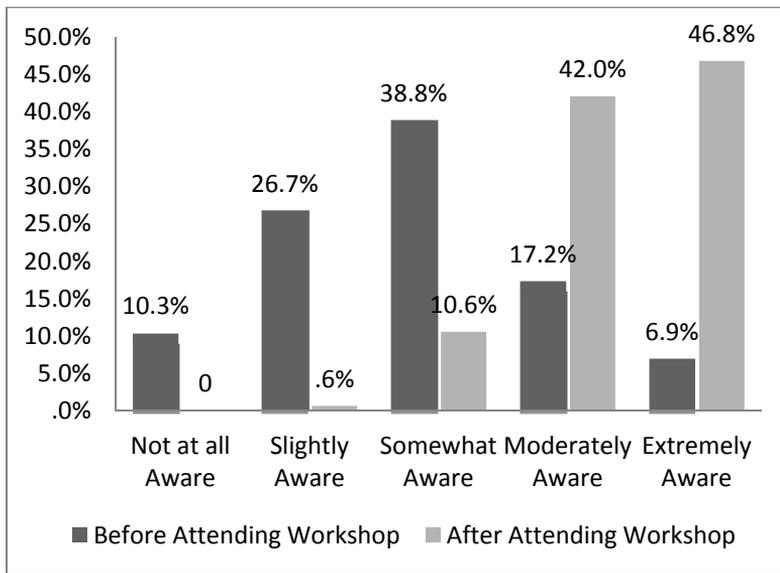
#### 4.5 Changes in the Level of Sustainable Living and Environmental Awareness

A paired t-test was carried out to ascertain whether the workshop was effective or not. The output of the paired t-test is shown in Table 5. The concept of “sustainable campus and policy” has the highest difference in mean scores ( $M=1.864$ ,  $SD= 0.990$ ) conditions,  $t(21)= 8.828$ ,  $p<0.001$  and the concept of “effects of CO<sub>2</sub> emission” has the lowest difference in mean scores ( $M=1.179$ ,  $SD= 1.219$ ) conditions  $t(27)= 5.117$ ,  $p<0.001$ . It can be seen that the sample mean of the difference scores for all topics are positive and significantly greater than zero. Thus, UTM students, who attended the workshop, gained a higher level of knowledge and awareness about sustainable living and engineering.

**Table 5** Paired t-Test results for workshop topics

Item	Activity	Paired Differences		t	df
		Mean	SD		
Q1	Global Warming	1.333	1.038	6.676	26
Q 2	Effects of CO <sub>2</sub> emissions	1.179	1.219	5.117	27
Q 3	What is sustainable development?	1.519	1.122	7.031	26
Q 4	The Ecological footprint	1.360	0.952	7.141	24
Q 5	Construction & Sustainable Policy	1.444	0.892	8.418	26
Q 6	Why we need Sustainable Buildings.	1.680	1.108	7.584	24
Q 7	Sustainable Materials	1.722	1.018	7.179	17
Q 8	Embodied Energy	1.619	0.865	8.581	20
Q 9	Sustainable Orientation of Buildings	1.545	0.912	7.951	21
Q 10	What is building passive design?	1.800	1.105	7.285	19
Q 11	The Eco- House	1.217	1.043	5.600	22
Q 12	Eco-specifier and green materials	1.429	1.028	6.367	20
Q 13	Green Building	1.458	1.062	6.725	23
Q 14	How does a green building index work?	1.810	0.873	9.500	20
Q 15	Why we need a sustainable Campus.	1.692	0.970	8.893	25
Q 16	Sustainable Campus and Policy	1.864	0.990	8.828	21
Q 17	Recycle, Reuse and Reduce in Campus	1.450	1.276	5.081	19
Q 18	How to turn our campus into a green campus?	1.682	1.249	6.315	21
Q 19	Energy Efficiency on Campus	1.542	1.103	6.850	23

The results of the data analysis demonstrate that the environmental knowledge and awareness of students after attendance to the workshop increased. Figure 6 demonstrates that the level of awareness has a significantly shifted from “Slightly Aware” and “Somewhat Aware” before the workshop to “Moderately Aware” and “Extremely Aware” after the workshop. It reveals the fact that students achieved higher knowledge and awareness about sustainable living and engineering after receiving the training.



**Figure 6** Summary of the participants’ response toward level of awareness of the sustainability

#### 4.6 Training and Attitudes for Sustainable Living and Engineering

Table 6 reveals the mean scores and standard deviations (SD) of seven questions, which were designed to discover workshop effects on students’ attitude, training, and their level of satisfaction. The mean scores for all these items are equal or greater than four, which indicates that almost all students agree with these statements.

**Table 6** Effects of environmental training and attitude and participants' satisfaction

Item	Statement	Mean	SD
1	I am going to change my behavior to become more environmentally responsible.	4.26	0.613
2	I am going to persuade my friends and family to care more about the environment.	4.12	0.758
3	This workshop has contributed to my understanding of environmental issues.	4.09	0.763
4	I feel more responsible toward the environment after participating in this workshop.	4.30	0.680
5	I feel this workshop improved my quality of life.	4.09	0.635
6	I would recommend UTM to others because UTM cares about environmental issues.	4.05	0.666
7	I feel better about UTM after attending in this workshop.	4.00	0.824

#### 4.7 Future Decisions toward Sustainable Living

The mean scores and SDs in Table 7 show that students were interested in cooperating in developing sustainable living initiatives, however, “Recycling, Reusing and Reducing in Campus”, “Cooperating in Decreasing CO<sub>2</sub> Emission”, and “Developing Sustainable Building” were three fields that students were more concerned with developing in the future.

**Table 7** Future decision

Item	Statement	Mean	SD	Total (%) SA+A*
1	Cooperation for turning UTM campus to a Green campus	4.18	0.658	86.0
2	Using sustainable materials	4.26	0.695	86.0
3	Using sustainable energy	4.23	0.738	84.2
4	Developing green building	4.28	0.774	84.2
5	Developing sustainable buildings	4.32	0.736	87.7
6	Decreasing ecological footprint	4.14	0.811	73.7
7	Cooperating in decreasing CO <sub>2</sub> emissions	4.32	0.736	87.7
8	Recycling, reusing and reducing on campus	4.33	0.664	93.0

\*“Strongly Agree (SA)” and “Agree (A)”

This study explained the effects of workshop training in the concept of sustainable living and engineering amongst UTM's students. It is found that the workshop succeeded in enhancing students' knowledge and awareness to a level that would improve their ability to contribute to environmental improvement efforts. Now the students know the causes of and solutions to environmental issues, which are in part consequences of their own life style.

At the end of the workshop, more than 80% of the students decided to use sustainable materials and energy. Moreover, almost 80% of the students were eager to educate their family and friends about sustainable living and the environment. Therefore, the knowledge and awareness of the students was improved and participants became more familiar with their responsibilities about sustainable living and environmental issues.

The results of this study identify that educational organizations should invest more in environmental training and educational programs. Such programs can improve students' knowledge and awareness and encourage them to participate in sustainable development process. UTM, which plans to reach the status of a green university in Malaysia, should share the concepts of sustainable development through workshops, websites, and local newspapers to address the problems related to sustainable development and also to persuade students to collaborate in achieving a green university in Malaysia. As a result of education and environmental training, the staff and students of UTM will be aware of the barriers of sustainable development implementation in order to improve their life style and preserve natural resources and ecosystem.

## **5.0 CONCLUSION AND RECOMMENDATIONS**

It is necessary for organizations to move toward a more sustainable approach because in part to the increasing depletion of natural resources. The goal of UTM is to cooperate in developing more sustainable living and environment. For doing so, the students are considered a key element. To develop the concepts of sustainability, the level of sustainable living knowledge and environmental awareness should be promoted within the students. The students should be aware that they are not only partly responsible for environmental issues but most importantly, they can be part of the solution to such issues.

The significant contribution of this study is the confirmation that sustainable practice and environmental education are valuable and effective ways to enhance the level of sustainable and environment awareness. In order to verify this, a survey was carried out among a number of students at UTM during a workshop in November 2010. The survey evaluated the sustainable knowledge and awareness of the students before and after attending the workshop. The results of this survey reflect the remarkable impact of the workshop on raising the environmental knowledge and awareness of the students. It also reveals that men than women and graduate than undergraduate students achieve the higher level of knowledge in the most concepts. Now, the students are prepared to widely disseminate to family and friends information about the concept of sustainable development. Moreover, the students are able to contribute to UTM's efforts to of achieving a sustainable campus.

In regard to the results obtained in this study, UTM's organization should arrange more workshops and reading materials related to sustainable development and living for students. UTM requires an efficient and productive education and awareness systems to ensure that the necessary results would be acquired and students will know that a sustainable mindset is an essential element for preserving the environment and its natural resources. Future research should find appropriate solutions and address the obstacles of performing sustainable development in order to encourage societies to participate in sustainable development universally.

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